

congatec Application Note

Affected Products	All congatec modules
Subject	Enable Wake on LAN in Windows and Linux
Confidential/Public	Public
Author	HHI

Revision History

Revision	Date (yyyy-mm-dd)	Author	Changes
1.0	2023-02-01	HHI	Initial release

Preface

This application note provides information on how to set up the Wake-on-LAN feature in Windows 10 or Linux for any congatec module that supports Wake-on-LAN feature.

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Symbols

The following are symbols used in this application note.



Notes call attention to important information that should be observed.



Cautions warn the user about how to prevent damage to hardware or loss of data.



Warnings indicate that personal injury can occur if the information is not observed.

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Terminology

Term	Description
S3	Suspend to RAM
S4	Suspend to Disk
S5	Soft-off
UDP	User Datagram Protocol
WoL	Wake on LAN

1 Introduction

Wake-on-LAN (WoL) is a standardized feature for waking up a system from S3, S4 or S5 remotely via an Ethernet connection. The system enabled with WoL feature actively listens for a broadcast packet called the magic packet.

The magic packet is a network frame that contains 6 bytes (FF FF FF FF FF FF), followed by 16 repetitions of the MAC address of the device. Usually, the packet is sent via UDP to port 0, 6 or 9.

Before the broadcast can begin, you must:

- configure the system that you plan to wake up first (system that listens for broadcast packet).
- execute the WoL tool on the system that broadcasts the magic packet.

Because the magic packets are sent on a port that is below port 1024, the WoL tool must be executed with administrative rights.



Note

Because magic packets are not routable, the computer that sends the magic packet (broadcaster) must be in the same subnet with the computer that receives the packet (listener).

WoL feature will not work if both devices are in different subnets.

2 Configuration

Before you can use Wake-on-LAN feature on any operating system, the following configuration steps are required.

1. Enable the WoL feature in the BIOS setup menu if it is not enabled by default.
2. Configure the Operating System to support WoL.
 - a. For Windows:
 - Disable the fast startup feature.
 - Enable Ethernet wake feature.
 - Enable Ethernet “Wake on Magic packet” if disabled by default.
 - b. For Linux:
 - Configure the Ethernet adapter settings.

2.1 Enable WoL in BIOS Setup Menu

On some congatec modules, the Wake-on-LAN feature is enabled in the BIOS setup menu by default. On other congatec modules, the user must enable the Wake-on-LAN feature manually in the BIOS setup menu.

The location of the Wake-on-LAN feature in the BIOS setup menu differs from module to module. For the conga-TA7 for example, you can find the WoL feature in:

Advanced -> Chipset -> PCH -> PSE Configuration

Other likely BIOS setup locations for Wake-on-LAN features are:

- Advanced -> Chipset -> PCH
- Advanced -> [Name of Ethernet Controller] -> NIC Configuration

Note

To enter the congatec BIOS setup menu, press or <F2> during POST.

2.2 Configure the Operating System

The sections below describe how to enable Wake-on-LAN feature in Windows 10 and Linux.

2.2.1 Enable WoL in Windows 10

When Windows 10 is shut down, the system enters a hybrid shutdown mode by default. This mode is also known as "Fast Startup".

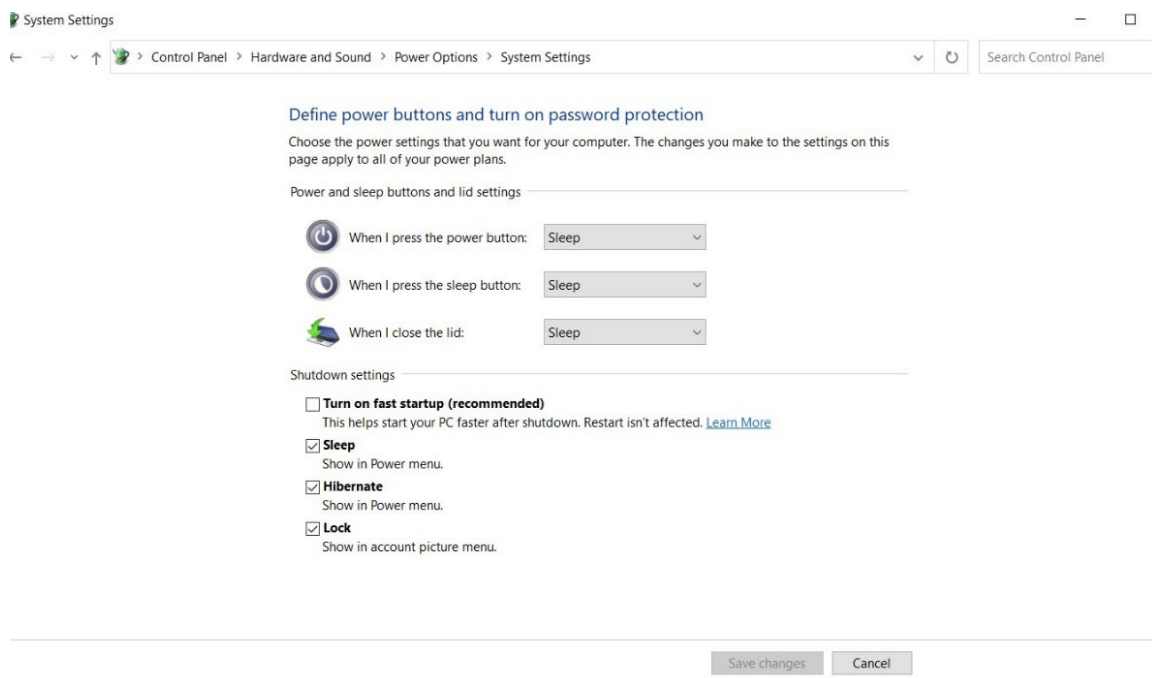
In Fast Startup mode, the ethernet adapter is not powered. Therefore, the WoL feature is not supported in Fast Startup mode.

Follow the procedures below to enable WoL feature in Windows 10.

1. Disable Fast Startup Mode

To support WoL in Windows 10, you must manually disable the Fast Startup mode which is enabled by default:

- Go to the Control Panel -> Hardware and Sound -> Power Options.
- Click "Choose what the power buttons do".
- Clear the "Turn on fast startup (recommended)" check box.



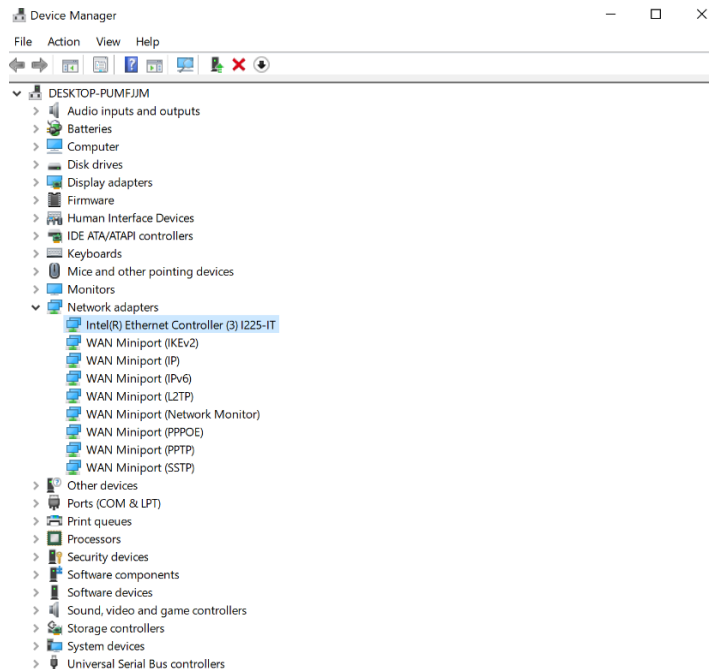
Note

To wake from S3 or S4, ensure the "Sleep" and "Hibernate" check boxes are selected.

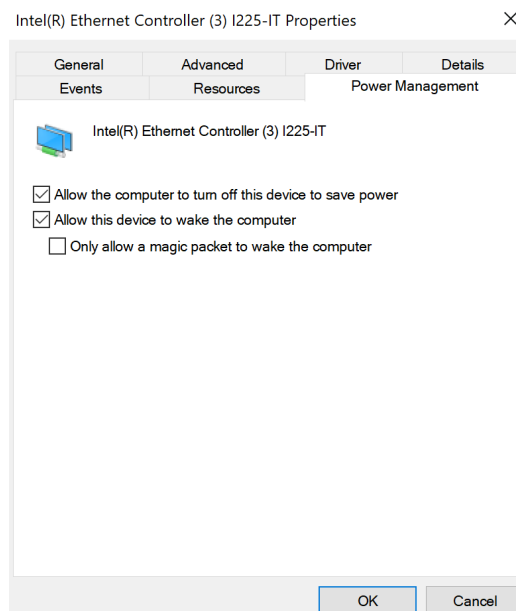
2. Enable Ethernet Wake Feature

The steps below enable the Ethernet adapter to wake the system from sleep.

1. Open **Device Manager**.
2. Expand **Network adapters**.
3. Right-click [name of your active Ethernet LAN adapter].



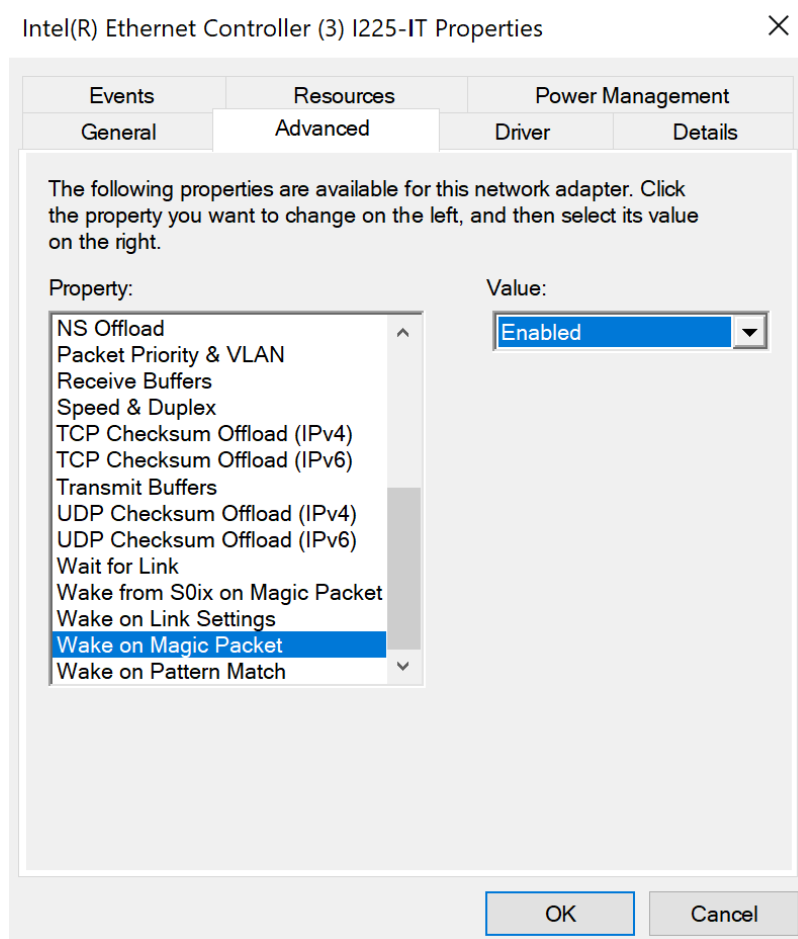
4. Click **Properties**. The Properties dialog box opens.
5. In the Properties dialog box, click the **Power Management** tab.
6. Select "Allow this device to wake the computer".



3. Enable Ethernet Wake on Magic Packet (S3, S4)

The Ethernet Wake on Magic Packet is enabled by default in many Ethernet LAN adapters. Follow the steps below to check if your Ethernet adapter is enabled or disabled.

1. Follow steps 1 – 4 in section 2.2.1, procedure 2 “Enable Ethernet Wake Feature” to open the Ethernet Properties dialog box.
2. In the Properties dialog box, click the **Advanced** tab.
3. Under “Property”, select **Wake on Magic Packet**
4. Check the status under “Value”. Select **Enabled** if disabled by default.



Note

These steps enable Wake on Magic Packet in S3 and S4 modes only.

Wake on Magic Packet in S5 Mode (Intel Network Adapters Only)

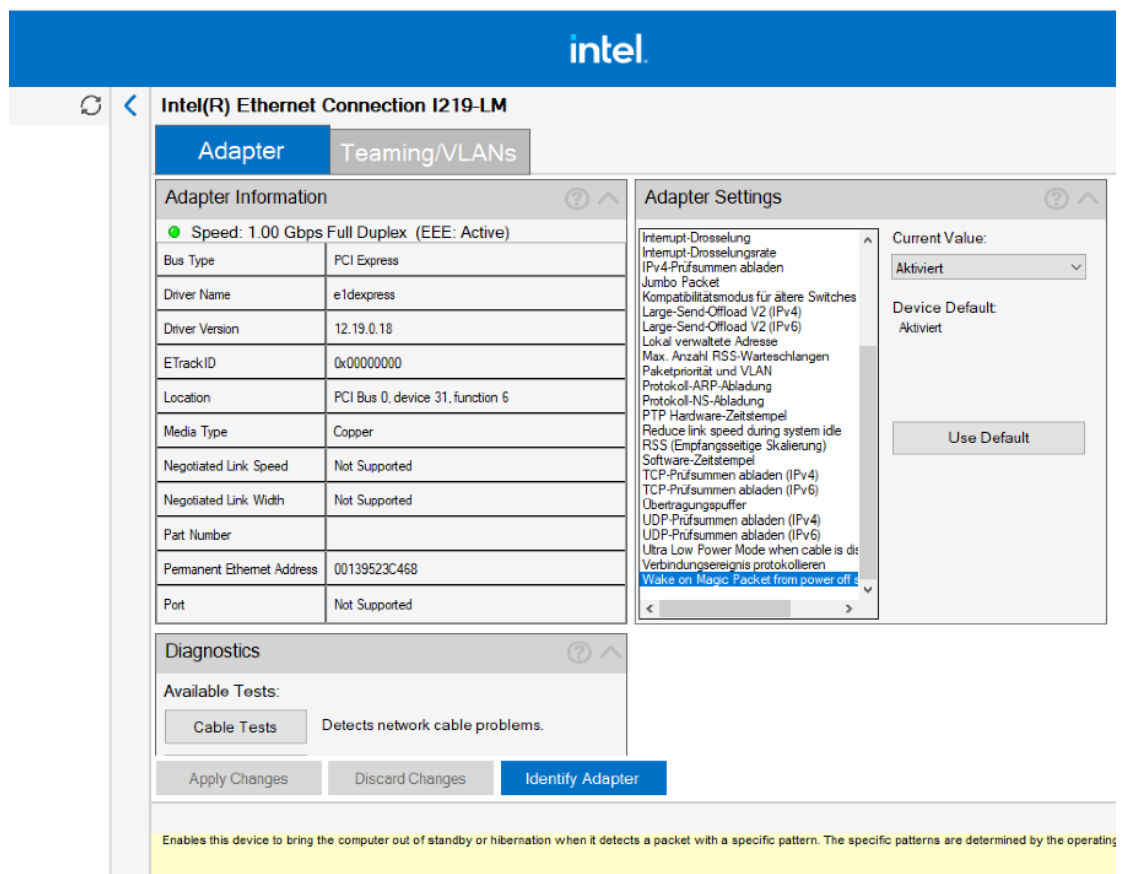
By default, Windows 10 supports wake from S3 and wake from S4 only. To wake the system from S5 when using Intel Network adapter, you need the Intel PROSet Adapter Configuration Utility.

The steps to obtain and enable Wake on Magic Packet in S5 mode when using Intel Network adapter are described below:

1. Download the latest Intel PROSet Adapter Configuration Utility.
2. Unzip the files to a directory on the system.
3. Run the executable file to install the configuration utility.

After completion, the configuration interface for your Intel Network adapter displays.

4. Click **Adapter** tab.



The screenshot shows the Intel PROSet Adapter Configuration Utility interface for an Intel(R) Ethernet Connection I219-LM. The 'Adapter' tab is selected, displaying 'Adapter Information' and 'Adapter Settings'. The 'Adapter Information' section includes details such as Speed (1.00 Gbps Full Duplex), Bus Type (PCI Express), Driver Name (e1dexpress), and Location (PCI Bus 0, device 31, function 6). The 'Adapter Settings' section lists various network features, with 'Wake on Magic Packet from power off state' selected. The 'Current Value' dropdown is set to 'Aktiviert'. A yellow banner at the bottom explains the function: 'Enables this device to bring the computer out of standby or hibernation when it detects a packet with a specific pattern. The specific patterns are determined by the operating system.'

5. Under "Adapter Settings", select **Wake on Magic Packet from power off state**.
6. Check the status under "Current Value". Select **Enabled** if disabled by default.

2.2.2 Enable WoL in Linux



Note

The congatec modules that feature Elkhart Lake CPUs can send WoL packets in both Windows and Linux Operating Systems. However, the modules cannot receive WoL packets in Linux because the auto-configuration of the Ethernet PHY on the modules is disabled due to compatibility issues.

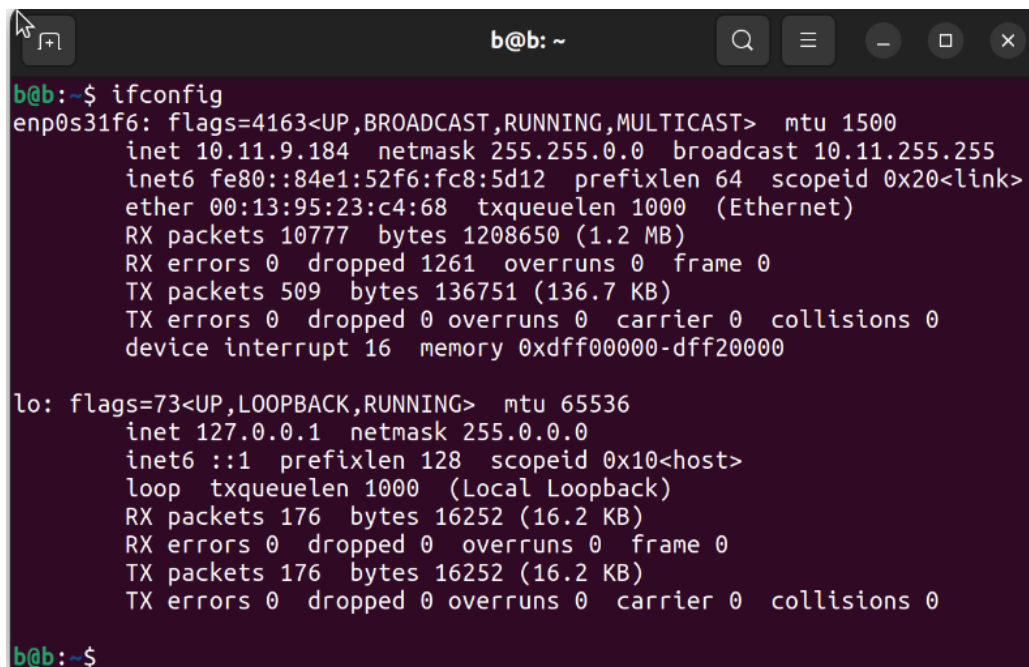
To wake congatec modules equipped with Elkhart Lake CPU, you must do the following:

- 1. Operate the congatec module in Windows 10*
- 2. Send WoL packets from Etherwake tool (in Linux)*

Follow the steps below to enable WoL in Linux.

1. Find the name of the Ethernet Network adapter that will wake the remote system:

```
$ ifconfig
```



```
b@b:~$ ifconfig
enp0s31f6: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
  inet 10.11.9.184 netmask 255.255.0.0 broadcast 10.11.255.255
  inet6 fe80::84e1:52f6:fc8:5d12 prefixlen 64 scopeid 0x20<link>
  ether 00:13:95:23:c4:68 txqueuelen 1000 (Ethernet)
  RX packets 10777 bytes 1208650 (1.2 MB)
  RX errors 0 dropped 1261 overruns 0 frame 0
  TX packets 509 bytes 136751 (136.7 KB)
  TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
  device interrupt 16 memory 0xdff00000-dff20000

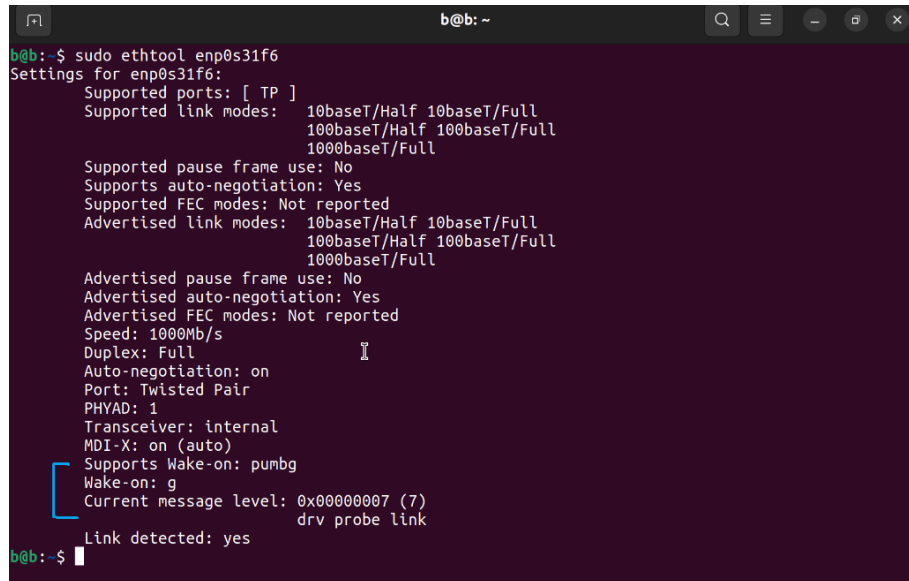
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
  inet 127.0.0.1 netmask 255.0.0.0
  inet6 ::1 prefixlen 128 scopeid 0x10<host>
  loop txqueuelen 1000 (Local Loopback)
  RX packets 176 bytes 16252 (16.2 KB)
  RX errors 0 dropped 0 overruns 0 frame 0
  TX packets 176 bytes 16252 (16.2 KB)
  TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

b@b:~$
```

Here the Ethernet Network adapter is enp0s31f6, distinguishable by its IP and MAC addresses.

2. Check if the Ethernet Network adapter supports Wake on Magic Packet by default:

```
$ sudo ethtool [Ethernet Network adapter]
```



```
b@b: ~  
b@b:~$ sudo ethtool enp0s31f6  
Settings for enp0s31f6:  
Supported ports: [ TP ]  
Supported link modes: 10baseT/Half 10baseT/Full  
100baseT/Half 100baseT/Full  
1000baseT/Full  
  
Supported pause frame use: No  
Supports auto-negotiation: Yes  
Supported FEC modes: Not reported  
Advertised link modes: 10baseT/Half 10baseT/Full  
100baseT/Half 100baseT/Full  
1000baseT/Full  
  
Advertised pause frame use: No  
Advertised auto-negotiation: Yes  
Advertised FEC modes: Not reported  
Speed: 1000Mb/s  
Duplex: Full  
Auto-negotiation: on  
Port: Twisted Pair  
PHYAD: 1  
Transceiver: internal  
MDI-X: on (auto)  
Supports Wake-on: pumbg  
Wake-on: g  
Current message level: 0x00000007 (7)  
drv probe link  
Link detected: yes  
b@b:~$
```

This command displays information about the capabilities of your Ethernet Network adapter.

- a. If the letter next to Wake-on is g, the Wake on Magic Packet is enabled.
 - b. If the letter is d or any other letter, Wake on Magic Packet is disabled by default. Continue with the next steps to enable Wake on Magic Packet.
3. Save the configuration.

- a. Open the **wol.service** file:

```
$ gedit /etc/system/system/wol.service
```

- b. Copy the following text to the file:

```
[Unit]  
Description=Configure Wake-up on LAN  
After=network-online.target  
  
[Service]  
Type=oneshot  
ExecStart=/usr/sbin/ethtool -s [NIC] wol g  
  
[Install]  
WantedBy=basic.target
```



You must replace the [NIC] with the name of your Ethernet Network adapter without the brackets.

- c. Save the wol.service file.

4. Enable the WoL service.

```
$ systemctl enable wol.service
```

```
$ systemctl daemon-reload
```

5. Reboot the system.

```
$ sudo reboot
```

After restarting the system, the Wake-On feature will always be available after a shutdown.

3 Wake-on LAN Tools

The following are some of the tools for configuring Wake-on LAN:

- Etherwake (Linux)
- Wol.exe (Windows 10)
- Fusion WoL (Windows 10)



Note

Use Etherwake WoL tool (Linux) to wake congatec modules equipped with Elkhart Lake CPUs.

3.1 Etherwake (Linux)

Etherwake is a Linux command line tool on most Linux-based distributions that can send magic packets to specified MAC-Address. On Fedora and some distributions, the tool may be called ether-wake.

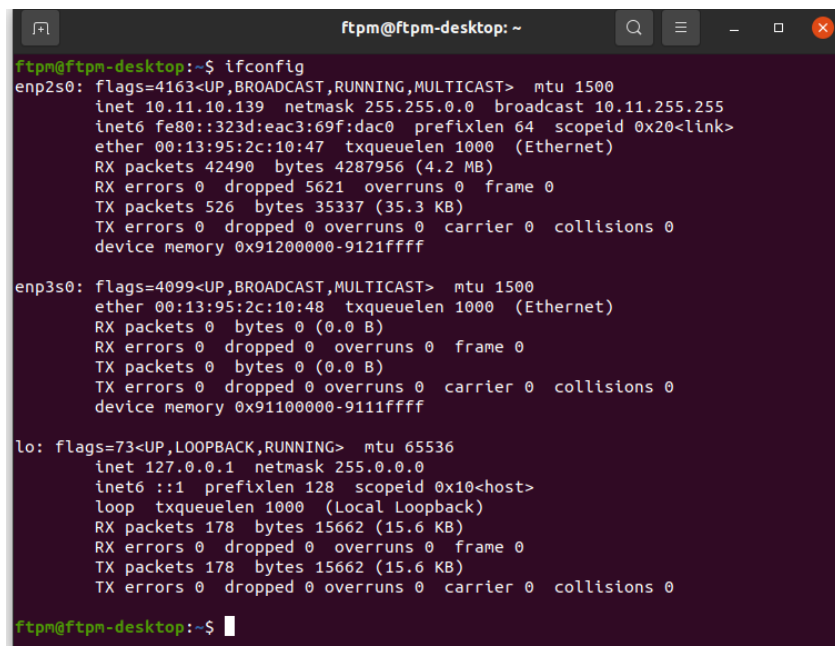
Some of the etherwake-related commands are shown below:

- Install etherwake tool:

```
$ apt install etherwake
```

- Find the name and MAC address of the Ethernet Network adapter:

```
$ ifconfig
```

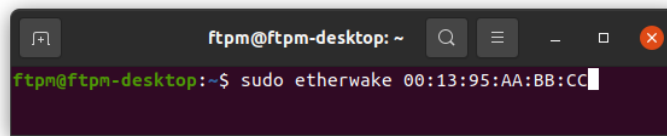


```
ftpm@ftpm-desktop: ~  
ftpm@ftpm-desktop:~$ ifconfig  
enp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 10.11.10.139 netmask 255.255.0.0 broadcast 10.11.255.255  
inet6 fe80::323d:eac3:69f:dac0 prefixlen 64 scopeid 0x20<link>  
ether 00:13:95:2c:10:47 txqueuelen 1000 (Ethernet)  
RX packets 42490 bytes 4287956 (4.2 MB)  
RX errors 0 dropped 5621 overruns 0 frame 0  
TX packets 526 bytes 35337 (35.3 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
device memory 0x91200000-9121ffff  
  
enp3s0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500  
ether 00:13:95:2c:10:48 txqueuelen 1000 (Ethernet)  
RX packets 0 bytes 0 (0.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 0 bytes 0 (0.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
device memory 0x91100000-9111ffff  
  
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 178 bytes 15662 (15.6 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 178 bytes 15662 (15.6 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
ftpm@ftpm-desktop:~$
```

Here the Ethernet Network adapter is enp0s31f6, distinguishable by its IP and MAC addresses

- Wake the system:

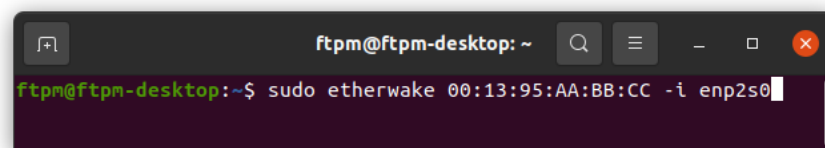
\$ Etherwake [MAC-Address]



```
ftpm@ftpm-desktop: ~  
ftpm@ftpm-desktop:~$ sudo etherwake 00:13:95:AA:BB:CC
```

- Specify the name of the ethernet adapter if the ethernet adapter is not eth0:

\$ Etherwake [MAC-Address] -i [interface]



```
ftpm@ftpm-desktop: ~  
ftpm@ftpm-desktop:~$ sudo etherwake 00:13:95:AA:BB:CC -i enp2s0
```

3.2 Wol.exe (Windows 10)

Wol.exe is a Windows 10 DOS command line tool for Wake on LAN. Follow the steps below to wake the remote system using Wol.exe tool:

1. Download wol.exe.
2. Copy the downloaded wol.exe file to Windows 10 home directory ([Drive]:/Users/[Username]).
3. Open the DOS command prompt of your system.

If the Wol.exe file is not stored in Windows 10 home directory, change the DOS command prompt to the directory where the file is stored with either of the methods below:

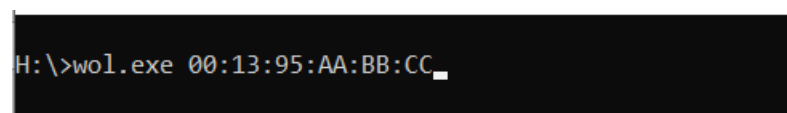
- (a) Type the command and press Enter.

H: \>cd [path to the stored wol.exe file]

- (b) Drag the folder to the DOS command prompt and press Enter.

4. Type the command below to wake up the remote system:

wol.exe [MAC address]



```
H: \>wol.exe 00:13:95:AA:BB:CC
```


3.3 Fusion WOL (Windows 10)

Fusion WOL is a Windows 10 application. With Fusion WOL, you can wake a system if you know the IP address or the MAC address.

Follow the steps below to wake the remote system using Fusion WOL application.

1. Download and install Fusion WoL application.
2. Go to the installed directory and double click the executable file to open the application. Fusion WOL user interface opens.
3. Type the IP address of the remote system.
4. Click **Get MAC** button to get the MAC address of the remote system.
5. Click **Turn on PC** button to wake the remote system. A message appears notifying the user about the success or failure of the Wake event.

