

# Managing network teaming devices

## WHAT?

Combine two or more network interfaces into a single teamed device.

## WHY?


Network teaming can increase bandwidth and/or provide redundancy.

## EFFORT

Approximately 15 minutes to read and understand the content.

## REQUIREMENTS

- Network connection
- Basic understanding of networking and IP addresses
- Existing network interfaces to include in the teamed device
- Switch support, depending on the teaming mode
- The package libteam-tools is installed

This article is about network *teaming*. To configure network *bonding*, see [Managing network bonding devices \(https://documentation.suse.com/smart/network/html/network-bond-managing-devices/index.html\)](https://documentation.suse.com/smart/network/html/network-bond-managing-devices/index.html) .

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# 1 Configuring network teaming

Network teaming combines two or more network interfaces into a single teamed device to increase bandwidth and/or provide redundancy. The behavior of the teamed device is configured using *teaming modes*.

## 1.1 Requirements

- Network connection
- Basic understanding of networking and IP addresses
- Existing network interfaces to include in the teamed device
- Switch support, depending on the teaming mode
- The package `libteam-tools` is installed

## 1.2 Restrictions

### Do not split teams over multiple switches

In most hardware setups, all network interfaces in a teamed device must be connected to the same switch. For more information, consult your switch vendor documentation.

### No teaming in YaST

Currently, YaST cannot create a teamed device. You must configure network teaming manually.

### Teaming and virtualization

Teamed devices are made up of multiple network interfaces. In most configurations you should only configure teaming in the host. Virtual interfaces to guests are then created as a bridge with the teamed devices, simplifying guest creation and deployment.

It is possible, but not recommended, to configure teaming in a guest. When configuring teaming in a guest, you must assign multiple interfaces to the guest and configure the host without teaming. You must also be careful to configure the host and its network bridges so that you do not mix teaming in the host and guests.

## 1.3 Teaming modes

The following teaming modes are available:

### *broadcast*

All traffic is broadcast on all interfaces. Provides fault tolerance. Requires switch support.

### *roundrobin*

Packets are transmitted in round-robin fashion from the first to the last available interface. Provides fault tolerance and load balancing. Requires switch support.

### *activebackup*

Only one network interface is active. If it fails, a different interface becomes active. Provides fault tolerance.

### *loadbalance*

The teamed device transmits packets via all its interfaces, performing load balancing (passive or active) with a use of hash functions. For passive load balancing, only the BPF hash function is used. For active load balancing, the runner finds the best balance by moving hashes between available interfaces. Provides fault tolerance and load balancing. No specific switch support is required.

### *lacp*

All interfaces in the LACP group must share the same speed and duplex settings, and must be connected to the same switch. Provides fault tolerance and load balancing. Requires **ethtool** support in the interface drivers, and a switch that supports and is configured for IEEE 802.3ad Dynamic link aggregation. If your switch supports it, this is the preferred mode.

Consult your hardware manual to check which modes your switch supports.

## 1.4 Configuring network teaming with `ifcfg`

1. Create a configuration file named `/etc/sysconfig/network/ifcfg-team0`. If you need more than one teamed device, give them ascending numbers. For more information, see **man ifcfg**, **man ifcfg-team**, and `/etc/sysconfig/network/ifcfg.template`.

In the configuration file, define the following parameters:

```
STARTMODE=MODE ❶  
BOOTPROTO=IP_ASSIGNMENT ❷
```

```

IPADDR=IPv4_ADDRESS ③
IPADDR6=IPv6_ADDRESS ③

TEAM_RUNNER="TEAMING_MODE" ④

TEAM_PORT_DEVICE_0="FIRST_DEVICE_NAME" ⑤
TEAM_PORT_DEVICE_1="SECOND_DEVICE_NAME" ⑤

TEAM_LW_NAME="LINK_WATCHER" ⑥

```

- ① Defines how the teamed device starts. Use `auto` to start the interface automatically on every reboot, or use `manual` to prevent the interface from starting automatically.
- ② Defines how IP addresses are assigned to the teamed device. Use `static` to manually assign static IP addresses, or use `dhcp` to automatically assign dynamic IP addresses.
- ③ Specifies the IPv4 and IPv6 addresses for the device, if you are manually assigning `static` IP addresses.
- ④ Defines the teaming mode for this interface. Some teaming modes require additional variables. See `man ifcfg-team` for more information about mode-specific variables.
- ⑤ Specifies two or more network interfaces to include in the teamed device.
- ⑥ Defines a link watcher to monitor the state of subordinate devices.  
 The default option `ethtool` only checks if the device is up and accessible. This option is fast, but does not check if the device can actually send or receive packets.  
 If you need higher confidence in the connection, use the `arp_ping` option. This sends pings to a host specified by the variable `TEAM_LW_ARP_PING_TARGET_HOST`.  
 The teamed device is only considered to be up if replies are received.  
 See `man ifcfg-team` for more information about watcher-specific variables.

#### EXAMPLE 1: CONFIGURATION FOR LOAD BALANCING WITH `lACP`

```

STARTMODE=auto
BOOTPROTO=static
IPADDR="192.168.1.1/24"
IPADDR6="fd00:deca:fbad:50::1/64"

TEAM_RUNNER="lACP"
TEAM_LACP_SELECT_POLICY="lACP_prio"
TEAM_LACP_TX_HASH="ipv4,ipv6,eth,vlan"
TEAM_LACP_TX_BALANCER_NAME="basic"
TEAM_LACP_TX_BALANCER_INTERVAL="100"

TEAM_PORT_DEVICE_0="eth0"

```

```
TEAM_PORT_DEVICE_1="eth1"

TEAM_LW_NAME="ethtool"
TEAM_LW_ETHTOOL_DELAY_UP="10"
TEAM_LW_ETHTOOL_DELAY_DOWN="10"
```

#### EXAMPLE 2: CONFIGURATION FOR FAILOVER WITH `activebackup`

```
STARTMODE=auto
BOOTPROTO=static
IPADDR="192.168.1.2/24"
IPADDR6="fd00:deca:fbad:50::2/64"

TEAM_RUNNER=activebackup

TEAM_PORT_DEVICE_0="eth0"
TEAM_PORT_DEVICE_1="eth1"

TEAM_LW_NAME=ethtool
TEAM_LW_ETHTOOL_DELAY_UP="10"
TEAM_LW_ETHTOOL_DELAY_DOWN="10"
```

2. Back up the existing `ifcfg` files for the network interfaces that you included in the teamed device, in case you need to restore them later.
3. Remove the `ifcfg` files of the network interfaces that you included in the teamed device. Do not remove the backup files.
4. Check if everything is included in Wicked's configuration file:

```
> sudo wicked show-config
```

5. Start the teamed device:

```
> sudo wicked ifup all team0
```

If you need additional debug information, use the option `--debug all` after the `all` subcommand.



Do *not* use `systemctl` to start or stop the teamed device. Always use the `wicked` command.

## 6. Check the status of the teamed device:

- Get the state of the `teamd` instance from Wicked:

```
> sudo wicked ifstatus --verbose team0
```

- Get the state of the entire instance:

```
> sudo teamdctl team0 state
```

- Get the `systemd` state of the `teamd` instance:

```
> sudo systemctl status teamd@team0
```

Each command shows a slightly different view depending on your needs.

If you make changes to the `ifcfg-team0` file after starting the device, reload its configuration with the command `wicked ifreload team0`.

## 2 Adding VLANs over a teamed device

VLANs allow the running of multiple *logical* (virtual) Ethernet over one single physical Ethernet. They logically split the network into different broadcast domains so that packets are only switched between members that are designated for the same VLAN.

### 2.1 Requirements

- VLAN tags are enabled on the switch. Consult your hardware manual for details.
- To use load balancing for the teamed device, the switch must support LACP (802.3ad).
- A teamed device is already configured.

### 2.2 Adding VLANs over a teamed device

The examples in this procedure use the IP addresses `192.168.10.1` and `192.168.20.1`. Replace these with the actual IP addresses for your devices.

1. In `/etc/sysconfig/network`, create a file named `ifcfg-vlan0` and add the following content:

```
STARTMODE="auto"  
BOOTPROTO="static" ❶  
IPADDR='192.168.10.1/24' ❷  
ETHERDEVICE="team0" ❸  
VLAN_ID="0" ❹  
VLAN='yes'
```

- ❶ Specifies that the IP address is fixed.
  - ❷ Defines the IP address and netmask.
  - ❸ Contains the real interface to use for the VLAN interface. This example uses the teamed device `team0`.
  - ❹ Specifies a unique ID for the VLAN.
2. Copy the file `/etc/sysconfig/network/ifcfg-vlan0` to `/etc/sysconfig/network/ifcfg-vlan1` and change the following values:

- `IPADDR='192.168.20.1/24'`.
- `VLAN_ID='1'`.

3. Start the two VLANs:

```
> sudo wicked ifup vlan0 vlan1
```

4. Check the status of the VLANs:

```
> ip addr
```

You can check a specific device by using the `show` subcommand:

```
> ip addr show vlan0
```



### 3 Removing a teamed device

Use this procedure to remove the configuration for a bonded or teamed device and restore the member interfaces to their original, separate configuration.

The following examples use the device name `team0`. Replace this with the actual name of your device.

1. Stop the device:

```
> sudo wicked ifdown team0
```

2. Hide the configuration file by renaming it from `/etc/sysconfig/network/ifcfg-team0` to `/etc/sysconfig/network/.ifcfg-team0`.

Alternatively, if you definitely do not need the configuration anymore, remove the file instead of renaming it.

3. To re-enable the network interfaces that were included in the device, restore their original configuration from the backup files.
4. Reload the network configuration:

```
> sudo wicked ifreload all
```

5. Check the status of the remaining network interfaces:

```
> ip addr
```

### 4 Network bonding or network teaming: feature comparison

*Network bonding* and *network teaming* are different methods for combining network connections to provide a single combined interface. Bonding is handled exclusively in the kernel. Teaming includes a small set of kernel modules that provide an interface for `teamd` instances, but everything else is handled in user space.


TABLE 1: BONDING AND TEAMING FEATURE COMPARISON

Feature	Bonding	Teaming
broadcast, round-robin TX policy	yes	yes
active-backup TX policy	yes	yes
LACP (802.3ad) support	yes	yes
hash-based TX policy	yes	yes
user can set hash function	no	yes
TX load-balancing support (TLB)	yes	yes
TX load-balancing support for LACP	no	yes
Ethtool link monitoring	yes	yes
ARP link monitoring	yes	yes
NS/NA (IPV6) link monitoring	no	yes
RCU locking on TX/RX paths	no	yes
port prio and stickiness	no	yes
separate per-port link monitoring setup	no	yes
multiple link monitoring setup	limited	yes
VLAN support	yes	yes
multiple device stacking	yes	yes

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