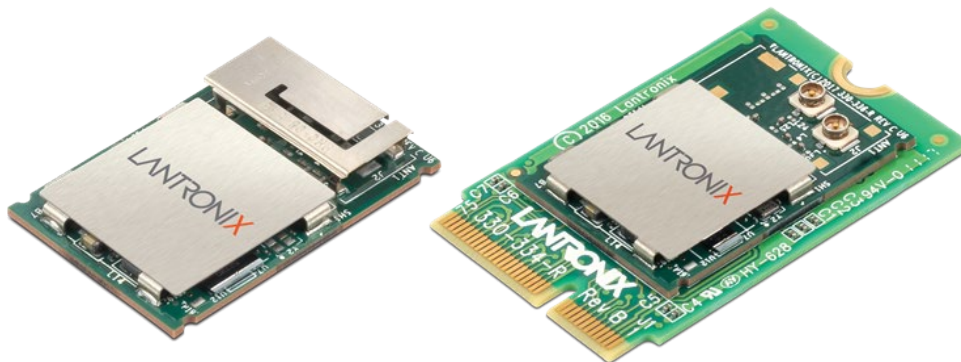


Application Note:

*xPico 200® Series –
Bridging eth0 to wlan0 or ap0*



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Revision History

| Date | Rev. | Comments |
|-----------|------|------------------|
| July 2022 | A | Initial release. |

For the latest revision of this product document, please check our online documentation at www.lantronix.com/support/documentation.

Overview

This document shows how to configure the xPico 200 series wireless modules to bridge an Ethernet connection to a Wi-Fi connection in version 5.1 firmware and higher. Bridging can be accomplished easily with the xPico 200 series devices but there are a few steps to do this correctly.

The screenshot shows the xPico 270 web interface. The top header displays 'xPico 270' and 'LANTRONIX'. The left sidebar contains a navigation menu with items like 'QuickConnect', 'Status', 'AES Credentials', 'Bluetooth', 'Bluetooth SPP', 'Bridge', 'CLI Server', 'Clock', 'ConsoleFlow', 'CPM', 'Device', 'Diagnostics', 'Discovery', 'File System', 'HTTP Server', 'Line', 'Network', 'NTP', 'Power', 'Radio', 'SPI', 'TLS Credentials', 'Tunnel', 'User', and 'WLAN Profiles'. The 'Bridge' item is highlighted. The main content area is titled 'Bridge Configuration' and includes a 'WARNING: Bridge configuration change requires reboot.' A form below has fields for 'Interface:' (set to 'wlan0'), 'Mode:' (radio buttons for 'Enabled' and 'Disabled', with 'Enabled' selected), and 'Allow All Multicast:' (radio buttons for 'Enabled' and 'Disabled', with 'Enabled' selected). A 'Submit' button is at the bottom of the form. The right sidebar shows 'admin' with a '[Logout]' button and a note: 'Bridging allows a "bridged machine" to send and receive frames via wlan0 or ap0. NOTE: A reboot is required for configuration changes to take effect.'

Figure 1: Enabling wlan0 bridge mode in the xPico 270 configuration.

Hardware and Software Requirements

In this document, the following are used:

- xPico 200 Series Evaluation Kit (the screenshots in this document were generated using an xPico 270 evaluation kit)
- A Windows or Linux computer with a free Ethernet port

Bridge Operation – MAC Substitution (wlan0 only)

Bridging eth0 to wlan0 cannot expose MAC addresses from the devices attached via Ethernet. The wlan0 bridge replaces the source device MAC addresses with the wlan0 MAC address when forwarding packets to the wireless network. Similarly, packets received on wlan0 from the wireless network being forwarded to eth0 will all have the Ethernet device MAC address destination.

These MAC addresses are inspected on layer-2 and stored in a table within the xPico 200's flash storage. The table can be viewed in the Web Manager by going to Bridge > Devices.

The MAC addresses in the table will be deleted after 2.5 hours of inactivity. A 2-hour TCP KeepAlive on the host or device will help retain them in the table indefinitely. If the eth0 interface goes down due to power loss or an unplugged cable, all of the MAC addresses are deleted.

Web Manager Configuration

Ensure that the CLI is enabled on the serial port as shown in Figure 2 below; Lantronix recommends enabling Telnet on interface eth0 only.

| | | |
|-------------------|--|---|
| QuickConnect | Status | Configuration |
| AES Credentials | CLI Server Configuration | |
| Bluetooth | WARNING: Non-secure Telnet Mode is enabled. Device is vulnerable to Cleartext Transmission of Sensitive Information. | |
| Bluetooth SPP | Inactivity Timeout: | 15 minutes |
| Bridge | Telnet | |
| CLI Server | Mode: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Clock | Interface: | eth0 |
| ConsoleFlow | Port: | 23 |
| CPM | | |
| Device | | |
| Diagnostics | | |
| Discovery | | |
| File System | | |
| HTTP Server | | |
| Line | | |
| Network | | |
| NTP | | |
| Power | | |
| Radio | | |
| SPI | | |
| TLS Credentials | | |
| Tunnel | | |
| User | | |
| WLAN Profiles | | |

Figure 2: Enabling CLI on the serial port.

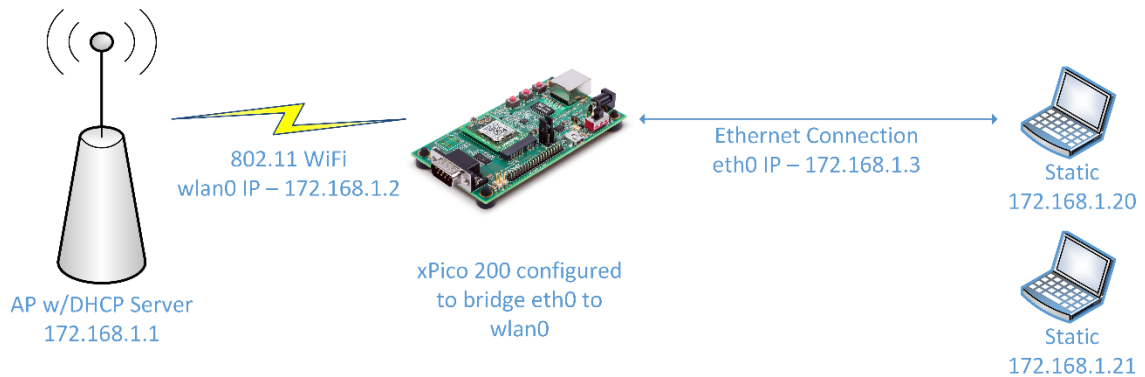
Enabling the CLI before applying bridge mode settings will ensure access to the xPico 200's settings.

Setup for Bridge Operation - Examples

This section describes example configurations for the following bridge mode scenarios:

- Static Bridge Mode: eth0 to wlan0
- Static Bridge Mode: eth0 to ap0
- DHCP Bridge Mode: eth0 to wlan0
- DHCP Bridge Mode: eth0 to ap0

Static Bridge Mode: eth0 to wlan0



In this scenario, the static IP address configuration allows the xPico 200 to act as a simple network bridge where IP addresses must be on the same subnet. Multiple bridged devices are supported.

Note that the Priority of the eth0 interface is set to 2, and the wlan0 interface is set to 1. This will prioritize wlan0 as the first interface choice when routing to an IP address from the xPico 200.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface eth0 Configuration

WARNING: Change in Interface settings will take effect on the next reboot.

| | |
|------------------|--|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Hostname: | <input type="text"/> |
| Priority: | <input type="text" value="2"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| DHCP Client: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| DHCP Server: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| IP Address: | <input style="border: 1px solid #ccc;" type="text" value="172.168.1.3"/> |
| Domain: | <input type="text"/> |
| Default Gateway: | <None> |
| Primary DNS: | <None> |
| Secondary DNS: | <None> |
| IPv6 State: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |

admin [\[Logout\]](#)

These settings pertain to the Network Interface on the device. To see the effect of these selections after a reboot, view the corresponding Status. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 3: Configuring eth0 to allow for static IP address bridge capability.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface wlan0 Configuration

| | |
|------------------|---|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Hostname: | <input type="text"/> |
| Priority: | <input type="text" value="1"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| DHCP Client: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| IP Address: | <input type="text" value="172.168.1.2"/> |
| Domain: | <input type="text"/> |
| Default Gateway: | <input type="text" value="172.168.1.1"/> |
| Primary DNS: | <input type="text" value="<None>"/> |
| Secondary DNS: | <input type="text" value="<None>"/> |
| IPv6 State: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |

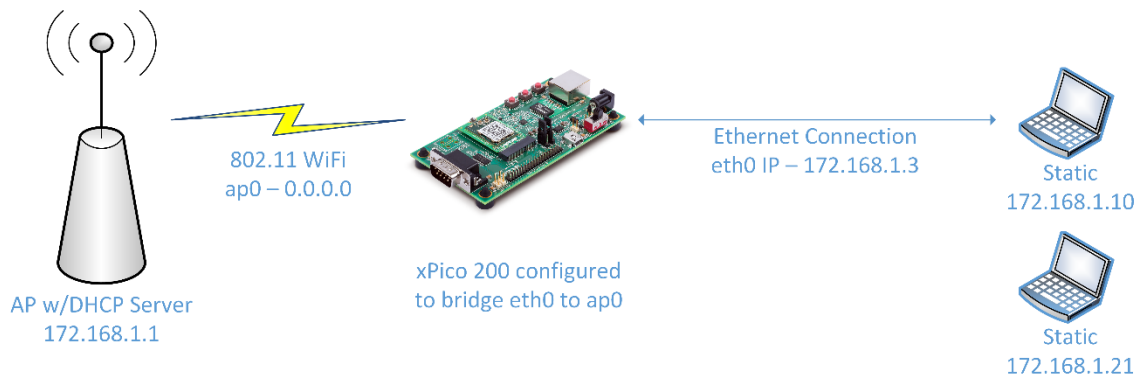
admin [\[Logout\]](#)

These settings pertain to the Network Interface on the device. To see the effect of these selections after a reboot, view the corresponding Status. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 4: Configuring wlan0 to allow for static IP address bridge capability.

Static Bridge Mode: eth0 to ap0



In this scenario, multiple bridged devices can communicate with the xPico 200 on the eth0 interface. Assigning IP address "0.0.0.0" to the ap0 interface will disable network services over ap0, including the DHCP server. All other IP addresses must be on the same subnet.

Either a static IP address or 0.0.0.0 (intentional transparent bridging) can be configured on the ap0 interface. If 0.0.0.0 is used, device services will not be available to ap0 devices; the Web Manager and other services will remain accessible from the eth0 side.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface eth0 Configuration

WARNING: Change in Interface settings will take effect on the next reboot.

| | |
|------------------|---|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Hostname: | <input type="text"/> |
| Priority: | <input type="text" value="1"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| DHCP Client: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| DHCP Server: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| IP Address: | <input type="text" value="172.168.1.3"/> |
| Domain: | <input type="text"/> |
| Default Gateway: | <None> |
| Primary DNS: | <None> |
| Secondary DNS: | <None> |
| IPv6 State: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |

admin [\[Logout\]](#)

These settings pertain to the **Network Interface** on the device. To see the effect of these selections after a reboot, view the corresponding **Status**. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 5: Configuring eth0 to allow for static IP address bridge capability.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0
eth0
wlan0
lo0

Interface
Link

Status
Counters
Configuration
Filter

Interface ap0 Configuration

| | | |
|---------------------------------------|---|-------|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled | |
| Priority: | <input type="text" value="1"/> | |
| MSS: | <input type="text" value="1460"/> | bytes |
| IP Address: | <input type="text" value="0.0.0.0"/> | |
| DHCP IP Address Range | | |
| <input type="button" value="Submit"/> | | |

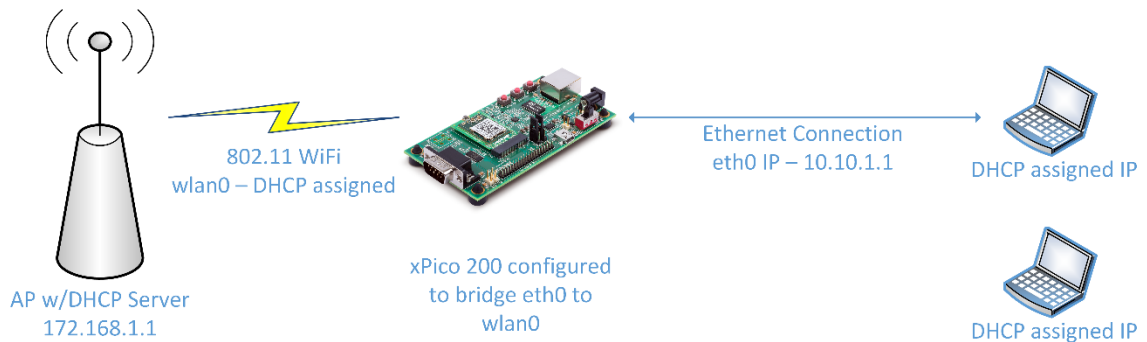
admin [\[Logout\]](#)

These settings pertain to the Network Interface on the device. To see the effect of these selections after a reboot, view the corresponding Status. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 6: Configuring ap0 to allow for static IP address bridge capability.

DHCP Bridge Mode: eth0 to wlan0



In this scenario, the DHCP server is in the wlan0 network. The xPico 200 will forward DHCP requests from bridged devices to the wlan0 DHCP server. Multiple devices are supported.

Note that the Priority of the eth0 interface is set to 2, and the wlan0 interface is set to 1. This will prioritize wlan0 as the first interface choice when routing to an IP address from the xPico 200.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface eth0 Configuration

WARNING: Change in Interface settings will take effect on the next reboot.

| | |
|------------------|---|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Hostname: | <input type="text"/> |
| Priority: | <input type="text" value="2"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| DHCP Client: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| DHCP Server: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| IP Address: | <input type="text" value="10.10.1.1"/> |
| Domain: | <input type="text"/> |
| Default Gateway: | <None> |
| Primary DNS: | <None> |
| Secondary DNS: | <None> |
| IPv6 State: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |

admin [\[Logout\]](#)

These settings pertain to the **Network Interface** on the device. To see the effect of these selections after a reboot, view the corresponding **Status**. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 7: Configuring eth0 to allow for DHCP address bridging.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface wlan0 Configuration

| | |
|------------------|---|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Hostname: | <input type="text"/> |
| Priority: | <input type="text" value="1"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| DHCP Client: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| IP Address: | <input type="text" value="<None>"/> |
| Domain: | <input type="text"/> |
| Default Gateway: | <input type="text" value="<None>"/> |
| DNS: | <input type="text" value="DHCP"/> |
| Primary DNS: | <input type="text" value="<None>"/> |
| Secondary DNS: | <input type="text" value="<None>"/> |
| IPv6 State: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |

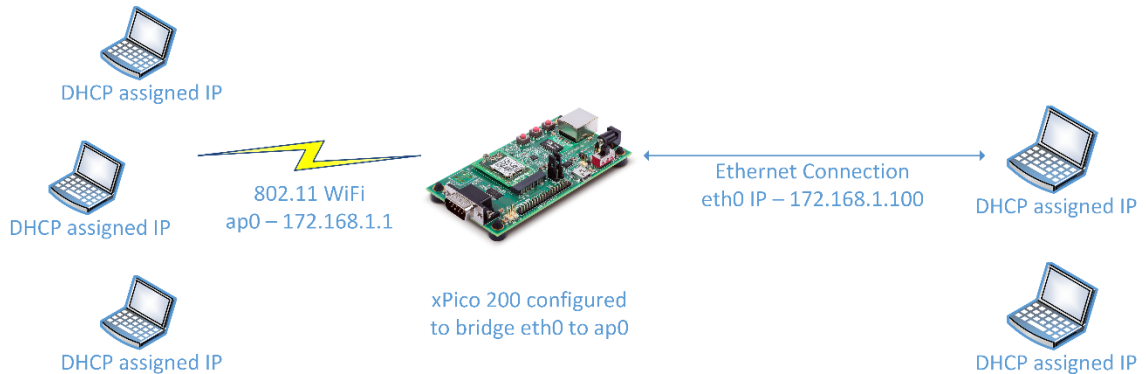
admin [\[Logout\]](#)

These settings pertain to the Network Interface on the device. To see the effect of these selections after a reboot, view the corresponding Status. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 8: Configuring *wlan0* to allow for *DHCP* address bridging.

DHCP Bridge Mode: eth0 to ap0



In this configuration, the ap0 interface acts as the DHCP server for any wireless bridged devices, and eth0 acts as the DHCP server for wired devices.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface eth0 Configuration

WARNING: Change in Interface settings will take effect on the next reboot.

| | |
|------------------------------|---|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Hostname: | <input type="text"/> |
| Priority: | <input type="text" value="1"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| DHCP Client: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| DHCP Server: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| IP Address: | <input type="text" value="172.168.1.100"/> |
| Domain: | <input type="text"/> |
| Default Gateway: | <input type="text" value="<None>"/> |
| Primary DNS: | <input type="text" value="<None>"/> |
| Secondary DNS: | <input type="text" value="<None>"/> |
| IPv6 State: | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| DHCP IP Address Range | |
| Start: | <input type="text" value="172.168.1.101"/> |
| End: | <input type="text" value="172.168.1.199"/> |

[admin](#) [\[Logout\]](#)

These settings pertain to the Network Interface on the device. To see the effect of these selections after a reboot, view the corresponding Status. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 9: Configuring eth0 to enable DHCP bridging.

- QuickConnect
- Status
- AES Credentials
- Bluetooth
- Bluetooth SPP
- Bridge
- CLI Server
- Clock
- ConsoleFlow
- CPM
- Device
- Diagnostics
- Discovery
- File System
- HTTP Server
- Line
- Network
- NTP
- Power
- Radio
- SPI
- TLS Credentials
- Tunnel
- User
- WLAN Profiles

ap0 eth0 wlan0 lo0

Interface Link

Status Counters Configuration Filter

Interface ap0 Configuration

| | |
|------------------------------|---|
| State: | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| Priority: | <input type="text" value="1"/> |
| MSS: | <input type="text" value="1460"/> bytes |
| IP Address: | <input type="text" value="172.168.1.1"/> |
| Default Gateway: | <input type="text" value="<None>"/> |
| Primary DNS: | <input type="text" value="<None>"/> |
| Secondary DNS: | <input type="text" value="<None>"/> |
| DHCP IP Address Range | |
| Start: | <input type="text" value="172.168.1.2"/> |
| End: | <input type="text" value="172.168.1.99"/> |

admin [\[Logout\]](#)

These settings pertain to the **Network Interface** on the device. To see the effect of these selections after a reboot, view the corresponding **Status**. Changes will take effect after reboot or wake from standby.

When ap0 is enabled, DHCP Server will assign IP addresses to ap0's clients. DHCP Server manages up to 6 simultaneous clients. (Only 5 if wlan0 is enabled.)

Figure 10: Configuring *ap0* to enable **DHCP** bridging.

Accessing the CLI Through Route Management

For use cases where the Web Manager or the CLI via Telnet access is needed via eth0 and resides on a different subnet from the bridged devices, each bridged device must add a route in order to reach eth0.

The two examples below (Windows and Linux) show how to add routes to access the eth0 IP address.

Windows

```
Route add aaa.bbb.ccc.ddd YY
```

Where `aaa.bbb.ccc.ddd` is the eth0 IP address and `YY` is the Windows interface number we are connected to the xPico 200 on.

Use the Windows command prompt to find the interface number with the `route print` command. In the below example, 29 would be used for `YY`.

```
29...f8 75 a4 dd e3 0b .....Intel(R) Ethernet Connection (6) I219-V
```

Linux

In Linux, use the following:

```
Route add aaa.bbb.ccc.ddd
```

Where `aaa.bbb.ccc.ddd` is the eth0 IP address.