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## 1. Introduction

This application note describes the process of setting up Ethernet Bridge mode for the following products: 1) Moxa's wireless NPort W2x50A series, and 2) Cisco's 2100/2500/4400/5500/Flex 7500 series wireless LAN controllers.

## 2. Applicable products

| Product Line        | Model Name                 |
|---------------------|----------------------------|
| NPort W2x50A Series | NPort W2150A, NPort W2250A |

## **3. System Requirements**

| Description              | Model / File Name     | S/W Version         |
|--------------------------|-----------------------|---------------------|
| Cisco WLC                | WLC 2100/2500/4400/   | 7.6.120.0 or later  |
|                          | 5500/Flex 7500 Series |                     |
| Cisco Lightweight AP     | AIR-LAP1142N-T-K9     |                     |
|                          | (Boot Version)        | 12.4.23.3           |
|                          | (IOS Version)         | 15.2(4)JB5\$        |
|                          | (Mini IOS Version)    | 7.3.1.73            |
| Moxa NPort W2x50A Series | W2x50A                | FW Ver 1.8 or later |

## 4. System Overview

The test system architecture is shown below in Figure 1.



Figure 1: Test system architecture

## **5.** Cisco Controller: Basic Configuration

#### 5.1. Enabling the WLAN Function

5.1.1. Log in to the controller's web graphical user interface (GUI) with username and password.

| cisco          | Windows Security   | ·      |
|----------------|--|--------|
| Wirele         | admin admin  Remember my credentials   | Login  |
|                | OK Cancel  |        |
| 2005-2009 Cisc | o Systems, Inc. All rights reserved. Cisco, the Cisco logo, and Cisco System | ms are |

#### Figure 2

5.1.2. Open the controller's web GUI and click the **WLANs** tab. Select **Create New** to create a new profile for the wireless connection, and then click **Go**.

| Nega                |                     |                                |  |   |   |   |   |
|---------------------|---------------------|--------------------------------|--|---|---|---|---|
| Mana                |                     |                                |  |   |   |   |   |
| ter: None           | Change Filter       | ] [Clear Filter]               |  |   |   | Create New  | • Go  |
| ID Type Profile Nan | ne WLAN SSID        | Admin Statu                    | is Security Polic                          | cies  |   |   |   |
|                     | ID Type Profile Nar | ID Type Profile Name WLAN SSID | ID Type Profile Name WLAN SSID Admin Statu | ID Type Profile Name WLAN SSID Admin Status Security Poli | ID Type Profile Name WLAN SSID Admin Status Security Policies | ID Type Profile Name WLAN SSID Admin Status Security Policies | ID Type Profile Name WLAN SSID Admin Status Security Policies |



5.1.3. Type the **Profile Name** and **SSID** in the input boxes, and then click **Apply**.

|                      | 1.                                 |                                   | Sa <u>v</u> e Configuration <u>P</u> ing Logout <u>R</u> efresh |
|----------------------|------------------------------------|-----------------------------------|---|
| WLANs                | WLANs > New                        |                                   | < Back Apply  |
| WLANs WLANs Advanced | Type<br>Profile Name<br>SSID<br>ID | WLAN •<br>test1<br>TS-TEST<br>2 • |   |



5.1.4. Navigate to **Security**  $\rightarrow$  **Layer 2**, and then select **WPA+WPA2**.

| General      | Security                                 | QoS Policy | -Mapping | Advanced |  |  |  |  |  |  |  |
|--------------|--|------------|----------|----------|--|--|--|--|--|--|--|
| Layer 2      | Layer 2 Layer 3 AAA Servers              |            |          |          |  |  |  |  |  |  |  |
| Layer 2      | Layer 2 Security  WPA+WPA2 MAC Filtering |            |          |          |  |  |  |  |  |  |  |
| Fast Trans   | Fast Transition                          |            |          |          |  |  |  |  |  |  |  |
| Fast Transit | Fast Transition                          |            |          |          |  |  |  |  |  |  |  |
| Protected    | Protected Management Frame               |            |          |          |  |  |  |  |  |  |  |
| PMF          |  | Disabled 🔻 |          |          |  |  |  |  |  |  |  |

Figure 5

5.1.5. Select **WPA2** for **Policy** and **AES** for **WPA2 Encryption**. Enable **PSK** for **Authentication Key Management**, choose **ASCII** for **PSK Format**, and enter the passphrase in the PSK Format input box (we use "1234567890" to illustrate).

| Layer 2 Layer 3           | AAA Servers  |
|---------------------------|--------------|
| Protected Management Fra  | me<br>_      |
| PMF                       | Disabled 🔻   |
| WPA+WPA2 Parameters       |              |
| WPA Policy                |              |
| WPA2 Policy               |              |
| WPA2 Encryption           | 🗹 AES 🛛 TKIP |
| Authentication Key Manage | ement        |
| 802.1X Enable             | e            |
| CCKM Enable               | e            |
| PSK 🕑 Enabl               | e            |
| FT 802.1X 📃 Enabl         | e            |
| FT PSK 📃 Enabl            | e            |
| PSK Format                | ASCII •      |
|                           | •••••        |
| WPA gtk-randomize State   | Disable 🔻    |

Figure 6

5.1.6. Return to the **General** tab and check the **Enabled** checkbox next to **Status**, and then click **Apply**. At this point, the basic wireless settings are done, and a wireless client will now be able to find the AP with an SSID TS-TEST.

| սիսիս    |                   |   | Save Configuration Ping                      | Logout   <u>R</u> efresh |
|----------|-------------------|---|--|--------------------------|
| WLANs    | WLANs > Edit 'te  | est1'   | < Back                                       | Apply                    |
| WLANS    | General Secu      | rity QoS Advanced   |  |                          |
| Advanced | Profile Name      | test1   |  |                          |
|          | Туре              | WLAN  |  |                          |
|          | SSID              | TS-TEST   |  |                          |
|          | Status            | Enabled   |  |                          |
|          | Security Policies | [WPA2][Auth(802.1X)]<br>(Modifications done under securit | tab will appear after applying the changes.) |                          |

Figure 7

## 6. Moxa NPort W2x50A Configuration

#### 6.1. Configuring the NPort W2x50A with the Wizard

6.1.1. Use an Ethernet cable to connect the NPort W2x50A to the network. Start NPort Search Utility and locate the NPort W2x50A. Double click on the selected NPort W2x50A to open the web console.

| D NPo | rt Searc         | h Utility   | -1-                |                |          |                       |                       |                       |        |
|-------|------------------|-------------|--------------------|----------------|----------|-----------------------|-----------------------|-----------------------|--------|
|       | t                | Search      | eip<br>🤷<br>Search | ≝<br>IP Locate | <u> </u> | sole Assign IP Un-    | Lock U <u>p</u> grade |                       |        |
| No Z  | M                | 4-1         |                    | LAN1 MAC A     | ddress   | LAN1 IP Address       | LAN2 MAC Address      | LAN2 IP Address       | Status |
|       |                  |             |                    |                |          |                       |                       |                       |        |
| Searc | ching<br>Searchi | ing for NPo | ıt                 |                |          |                       | E 01 (D 04)           |                       |        |
|       | Found            | 1 NPort(    | s), 9 sec          | cond(s) left.  |          |                       | Show IPv6 A           | ddress                | op     |
|       | No               | Mod         | iel                | LAN            | 11 MAC A | ddress   LAN1 IP Addr | ess 🕴 LAN2 MAC Ad     | dress   LAN2 IP Addre | 88     |
|       |                  |             |                    |                |          |                       |                       |                       |        |
|       |                  | _           |                    |                | _        |                       |                       |                       |        |
|       |                  |             |                    |                |          |                       |                       |                       |        |



6.1.2. Click **Wizard** in the Main Menu and then take the following steps to configure the NPort W2x50A's wireless connection.

Step 1: Input your NPort W2x50A's WLAN IP Configuration,

and then click **Next**.

| Main Menu<br>Overview<br>Wizard   | WLAN IP Configuration                                |   |
|---|--|---|
| Basic Settings<br>- Network Settings<br>- Serial Port Settings<br>- System Management<br>- System Monitoring<br>- Restart | IP configuration<br>IP address<br>Netmask<br>Gateway | Static         •           192.168.35.111         255.255.255.0 |
| goahead<br>WEBSERVER<br>Best viewed with IE 5 above at<br>resolution 1024 x 768   |  | Next  |



6.1.3. **Step 2**: Input the SSID for WLAN set-up, and then click **Next**. The SSID should be the same as for the Cisco controller configured in Step 5.1.3.

|                        | :• Step 2/5        |                       |  |
|------------------------|--------------------|-----------------------|--|
| - Main Menu            |                    |                       |  |
| Overview               |                    |                       |  |
| Wizard                 | General Properties |                       |  |
| Basic Settings         | Network type       | Infrastructure Mode 👻 |  |
| - Network Settings     | SSID               | TS-TEST               |  |
| - Serial Port Settings |                    |                       |  |
| - System Management    |                    |                       |  |
| - System Monitoring    |                    | Back Next             |  |
| - Restart              |                    |                       |  |



6.1.4. **Step 3**: Choose the authentication and encryption options that match the Cisco controller settings, and then click **Next**.

|                        | :• Step 3/5         |            |      |
|------------------------|---------------------|------------|------|
| - Main Menu            |                     |            |      |
| Overview               |                     |            |      |
| Wizard                 | Security Properties |            | 1    |
| Basic Settings         | Authentication      | WPA2-PSK - |      |
| - Network Settings     | Encryption          | AES-CCMP - |      |
| - Serial Port Settings | PSK passphrase      |            |      |
| - System Management    | i on passpinase     |            |      |
| - System Monitoring    |                     |            |      |
| - Restart              |                     | Back       | Next |
|                        |                     |            |      |



(NOTE: The PSK passphrase is "1234567890", the same as for the Cisco WLC setting.)
6.1.5. Step 4: Choose an Operation Mode for the W2x50A serial port to run, and then click Next.

|                        | :• Step 4/5                             |            |
|------------------------|---|------------|
| - Main Menu            |   |            |
| Overview               | The settings will be applied to all ser | ial ports. |
| Wizard                 | Operation Mode                          |            |
| Basic Settings         |   |            |
| - Network Settings     | Operation mode                          | Real COM - |
| - Serial Port Settings |   |            |
| - System Management    |   | Back Next  |
| - System Monitoring    |   |            |
| - Restart              |   |            |

Figure 12

6.1.6. **Step 5**: Set up the parameters for the W2x50A's serial ports, and then click **Next**.

| :•Step      | 5/5                                     |        |          |          |              |          |           |
|-------------|---|--------|----------|----------|--------------|----------|-----------|
| The setting | gs will be applied to all serial ports. | Parity | Data bit | Stop hit | Flow control | FIEO     | Interface |
| Alido       | 115200 -                                | Nono   | 0 -      | 1 -      |              | Enable - | PS 222 -  |



6.1.7. When the Wizard displays the settings summary, click **Submit**.

| - Main Menu                    | Your changes have not been saved Please | a chack that your cattings in the following and click "Submit" for the undates to take effect or click "Back" to modify it |  |  |  |  |  |
|--------------------------------|---|--|--|--|--|--|--|
| Overview                       | Tour changes have not been saved. Treas | e check that your settings in the following and check outprint for the updates to take energy of check to mounty it.       |  |  |  |  |  |
| Wizard                         | WLAN IP Configuration                   |  |  |  |  |  |  |
| Basic Settings                 | IP configuration                        | IP configuration static  |  |  |  |  |  |
| - Network Settings             | IP address                              | 192.168.35.111   |  |  |  |  |  |
| - Serial Port Settings         | Netmask                                 | 255.255.255.0  |  |  |  |  |  |
| - System Management            | General Properties                      |  |  |  |  |  |  |
| - System Monitoring            | Network type                            | Infrastructure Mode  |  |  |  |  |  |
| - Restart                      | SSID                                    | TS-TEST  |  |  |  |  |  |
|                                | Security Properties                     |  |  |  |  |  |  |
|                                | Authentication                          | WPA2-PSK   |  |  |  |  |  |
| Best viewed with IE 5 above at | Encryption                              | AES-CCMP   |  |  |  |  |  |
| resolution 1024 × 768          | Operation Mode                          |  |  |  |  |  |  |
|                                | Port 1                                  |  |  |  |  |  |  |
|                                | Operation mode                          | Real COM   |  |  |  |  |  |
|                                | Serial Parameters                       |  |  |  |  |  |  |
|                                | Bard rate                               | 38400  |  |  |  |  |  |
|                                | Parity                                  | None   |  |  |  |  |  |
|                                | Data bit                                | 8  |  |  |  |  |  |
|                                | Stop bit                                | 1  |  |  |  |  |  |
|                                | Flow contro                             | RTS/CTS  |  |  |  |  |  |
|                                | FIFO                                    | Enable   |  |  |  |  |  |
|                                | Interface                               | RS-232   |  |  |  |  |  |
|                                |   | Back Submit  |  |  |  |  |  |



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6.1.8. Restart the system to activate the settings. Click Restart → Restart
 System → Submit to perform the reboot. Disconnect the Ethernet cable before booting up to enable the wireless connection.

|                        | System restart   |
|------------------------|--|
| - Main Menu            | !!! Warning !!!  |
| Overview               | Clicking Restart will disconnect all serial and Ethernet connections and reboot            |
| Wizard                 | NOTE: Unequed configuration changes will be discarded, and data surrantly in the middle of |
| Basic Settings         |  |
| - Network Settings     |  |
| - Serial Port Settings | Submit   |
| - System Management    |  |
| - System Monitoring    |  |
| - Restart              |  |
| Restart System         |  |
| Restart Ports          |  |
|                        |  |



## 7. Configuring WLAN to Accept Bridged Devices

Network bridging is the action taken by network equipment to create an aggregate network from two or more network segments. When Ethernet Bridge mode is enabled in the W2x50A, the LAN and WLAN interfaces are bridged together. Data can be seamlessly transferred between serial lines, the LAN, and the WLAN. The LAN and WLAN will use the LAN IP setting, and the WLAN IP setting will be disabled. In what follows, we demonstrate how to configure Ethernet Bridge mode on the W2x50A and Cisco WLC.

#### 7.1. WLC Settings: Enabling Passive Client

7.1.1. Open the Cisco controller's web GUI, click CONTROLLER → General, enter a Multicast IP address in the input box, and then click Apply.

| ،، ،،، ،،<br>cısco  | <u>M</u> ONITOR <u>W</u> LANs   | <u>C</u> ONTROLLER          | W <u>I</u> RELESS                              | <u>S</u> ECURITY | M <u>A</u> NAGEMENT | C <u>o</u> mmands | Help | <u>F</u> EEDBACK |
|---|---|-----------------------------|--|------------------|---------------------|-------------------|------|------------------|
| Controller  | General   |                             |  |                  |                     |                   |      |                  |
| General<br>Inventory<br>Interfaces<br>Interface Groups<br>Multicast<br>Internal DHCP Server | Name<br>802.3x Flow Contro<br>Broadcast Forward<br>AP Multicast Mode<br>AP Fallback | ol Mode<br>ling<br><u>1</u> | Cisco_7d:e<br>Disabled<br>Enabled<br>Multicast | 5:80             | 55.255 N alticast   | : Group Addres:   | 5    |                  |

Figure 16

7.1.2. In the Cisco controller's web GUI, select CONTROLLER → Multicast, select Enable Global Multicast Mode, and then click Apply.

| ،،ا،،،ا،،<br>cısco                 | MONITOR WLANS CONTROLLER WIRELESS SECURITY              |
|------------------------------------|---|
| Controller                         | Multicast   |
| General<br>Inventory<br>Interfaces | Enable Global Multicast Mode 🗹<br>Enable IGMP Snooping  |
| Interface Groups<br>Multicast      | IGMP Timeout (seconds)60IGMP Query Interval (seconds)20 |

Figure 17

7.1.3. In the Cisco controller's web GUI, click **WLANs** → (**WLAN ID**) → **Advanced**, select **Passive Client**, and click **Apply**.

| cisco                        | Monitor <u>w</u> lans <u>c</u> ontroller w <u>i</u> reless <u>s</u> ecurity m <u>a</u> nagement (  | C <u>o</u> mmands he <u>l</u> p <u>f</u> eedback   |
|------------------------------|--|--|
| WLANs                        | WLANs > Edit 'test1'   |  |
| WLANS     WLANS     Advanced | General       Security       QoS       Advanced         IPVb Enable Z       Override Interface ACL       None •         P2P Blocking Action       Disabled •       •         Client Exclusion 3       Enabled       •         Maximum Allowed Clients 9       0       •         Static IP Tunneling 12       Enabled       •         Off Channel Scanning Defer       •       •         Scan Defer Priority       0       1       2       4       5       6       7         Scan Defer Time(msecs)       100       • <td>DTIM Period (in beacon intervals)         802.11a/n (1 - 255)         802.11b/g/n (1 - 255)         NAC         NAC State         NAC State         Client Load Balancing         Client Band Select         Client Band Select         Passive Client         Voice         Media Session Snooping         Enabled         Re-anchor Roamed Voice Clients</td> | DTIM Period (in beacon intervals)         802.11a/n (1 - 255)         802.11b/g/n (1 - 255)         NAC         NAC State         NAC State         Client Load Balancing         Client Band Select         Client Band Select         Passive Client         Voice         Media Session Snooping         Enabled         Re-anchor Roamed Voice Clients |

#### Figure 18

NOTE: According to Cisco, WLC only supports 8 MAC addresses behind a non-Cisco wireless client. For more details, please refer to the FAQ link below: http://www.cisco.com/c/en/us/support/docs/wireless/aironet-340-series/8018-workgroup-b ridge-faq.html#q18

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#### 7.2. W2x50A Settings: Enabling Ethernet Bridge

7.2.1. Open the NPort W2x50A web console.

Choose **Network Settings**  $\rightarrow$  **Ethernet/Bridge Settings**, select Ethernet bridge to **Enable** and assign an **IP address** and **Netmask** to the W2x50A, and then click **Submit**. The W2x50A will reboot and adopt the new settings.

| - Main Menu              | Network Sett                   | ing - Ethernet/Bridge |
|--------------------------|--------------------------------|-----------------------|
| Overview                 | - Network Oct                  | ing - Etherner Druge  |
| Wizard                   |                                |                       |
| Basic Settings           | Network Setting - Ethernet/Bri | dge                   |
| - Network Settings       | Ethernet bridge                | Enable -              |
| General Settings         | IP configuration               | Static -              |
| Ethernet/Bridge Settings | IP address                     | 192 168 32 80         |
| - WLAN Settings          |                                |                       |
| Advanced Settings        | Netmask                        | 255.255.255.0         |
| - Serial Port Settings   | Gateway                        |                       |
| - System Management      |                                |                       |
| - System Monitoring      |                                | Submit                |



NOTE: When Ethernet Bridge mode is enabled, the LAN and WLAN will both use the LAN IP setting, and the WLAN IP setting will be disabled.

## 8. Testing Ethernet Bridge

#### 8.1. Testing Ethernet Bridge

8.1.1. Connect the Cisco WCL + AP, W2x50A as described in the system overview on Page 2 (Figure 1). Check the WLC to see if the W2x50A has successfully established a connection with the Cisco AP. You will see the IP and MAC address of PC2 if the Passive Client is enabled. Click Monitor → Client and check to see if your W2x50A shows up in the list.

| սիսիս                       | _               |               |                    |                   |                  | S                   | a <u>v</u> e Configuration | <u>P</u> in <u>o</u> |
|-----------------------------|-----------------|---------------|--------------------|-------------------|------------------|---------------------|----------------------------|----------------------|
| CISCO                       | <u>M</u> ONITOR | <u>W</u> LANs | <u>C</u> ONTROLLER | W <u>I</u> RELESS | <u>S</u> ECURITY | M <u>A</u> NAGEMENT | C <u>O</u> MMANDS          | HE <u>L</u> P        |
| Monitor                     | Clients         |               |                    |                   |                  |                     |                            | Er                   |
| Summary                     | Current Filte   | er            | None               | [Change Filt      | er] [Clear Filte | <u>r</u> ]          |                            |                      |
| Access Points               |                 |               |                    |                   |                  |                     |                            |                      |
| Cisco CleanAir              | Client MAC      | Addr 1        | IP Address         | AP Name           | v                | VLAN Profile        | WLAN SSID                  |                      |
| Statistics                  | 70:f3:95:ff:d   | lb:f4         | 192.168.32.221     | APacf2.c59        | 4.0714 T         | S-TEST              | TS-TEST                    |                      |
| ▶ CDP                       |                 |               |                    |                   |                  |                     |                            |                      |
| Rogues                      |                 |               |                    |                   |                  |                     |                            |                      |
| Clients<br>Sleeping Clients |                 |               |                    |                   |                  |                     |                            |                      |



8.1.2. Ping both the W2x50A and PC2 from PC1; you will be able to reach both of them at the same time.



Figure 21

NOTE: W2x50A IP Address: 192.168.32.80; PC2 IP Address: 192.168.32.221.