

Configure Point-to-Point and Layer 2 Fluidity on Industrial Wireless (IW) Access Points

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Introduction

This document describes the configuration of a point-to-point link on an IW AP running in CURWB mode along with Fluidity layer 2 configuration.

Components Used

There are four different hardware:

- Cisco Catalyst IW9167
- Cisco Catalyst IW9165D
- Cisco Catalyst IW9165E

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

Background Information

CURWB hardware provides wireless backhaul over fixed and mobility architectures. This document describes the configuration of a point-to-point link on an Industrial Wireless Access Point (IW AP) running in CURWB mode along with Fluidity layer 2 configuration.

Configuring Point to point link with IW9165D

1. The radios can be configured from the IoT Operations Dashboard (IoT OD) or manually from the AP web interface. In this article, we configure all radios manually.
2. During initial setup, it is possible that console access is required. To connect to the console, use a baud rate of 115200, if the software version is 17.12.1 or newer.
3. By default, all radios are in IOT-OD online mode. Issue this command to verify the status of the AP.

```
show iotod-iw status
```

```
Cisco-137.250.148#show iotod-iw status
IOTOD IW mode: Offline
Cisco-137.250.148#
```

Use this command to change the mode on the AP to **offline** if it is configured to communicate with IoT OD.

```
configure iotod-iw offline
```

```
Cisco-137.250.148#configure iotod-iw
offline Set up IOTOD IW mode to offline
online Set up IOTOD IW mode to online. The device can be managed from the
IOTOD IW Cloud Server (if it is connected to the Internet)
Cisco-137.250.148#configure iotod-iw █
```

4. Once the radio is configured to be in offline mode, the Web GUI can be accessed by the default IP address 192.168.0.10.
5. From the GUI, configure point-to-point link with the radios from the **General Settings > General Mode** page.

General Mode

- Radio mode (Head End (which is connected to the Wired infrastructure) needs to be configured as mesh end and the remote end is configured as mesh point)

- IP address

- Subnet mask & Gateway

IOTOD IW

Offline

IW-MONITOR

Enabled

FM-QUADRO

GENERAL SETTINGS

- **general mode**
- wireless radio
- antenna alignment and stats

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

- advanced radio settings
- static routes
- allowlist / blocklist
- multicast
- snmp
- radius
- ntp
- ethernet filter
- l2tp configuration
- vlan settings
- Fluidity
- misc settings
- smart license

MANAGEMENT SETTINGS

- remote access
- firmware upgrade
- status
- configuration settings
- reset factory default
- reboot
- logout

Configuration contains changes. Apply these changes?

Discard

Review

Apply

GENERAL MODE

General Mode

Select MESH END mode if you are installing this Cisco IOT IW9165DH Series Access Point at the head end and connecting this unit to a wired network (i.e. LAN).

mesh point

Mode: mesh end

gateway

Radio-off:

LAN Parameters

Local IP:

Local Netmask:

Default Gateway:

Local Dns 1:

Local Dns 2:

Reset

Save

Once the parameters are configured, save the settings.

Wireless Radio

- Normally, for an IW9165, Radio 1 is configured for a point-to-point backhaul link as this is a directional internal antenna. For the use of only point-to-point applications, the second radio needs to be disabled.
- Both radios need to be configured with the same shared passphrase, frequency, and channel width.

IOTOD IW Offline
IW-MONITOR Enabled
FM-QUADRO

GENERAL SETTINGS

- general mode
- wireless radio
- antenna alignment and stats

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

- advanced radio settings
- static routes
- allowlist / blocklist
- multicast
- snmp
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- ntp
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- I2tp configuration

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WIRELESS RADIO

Wireless Settings

"Shared Passphrase" is an alphanumeric string or special characters excluding '[apex]' '[double apex]' '[backtick]' '\$[dollar]' '=' '[equal]' '\[backslash]' and whitespace (e.g. "mysecurecamnet") that identifies your network. It MUST be the same for all the Cisco URWB units belonging to the same network.

Shared Passphrase:

Show passphrase:

In order to establish a wireless connection between Cisco URWB units, they need to be operating on the same frequency.

Radio 1 Settings

Role: Fixed

Frequency (MHz): 5180

Channel Width (MHz): 20

Radio 2 Settings

Role: Disabled

Reset

Save

Once the page is configured, save the settings on both radios and apply the changes. This reboots the radios and the changes are then applied.

Monitoring the connectivity

Once the radios come are back, the signal strength from the antenna alignment page can be checked. The recommended signal strength is between -45 dBm and -70 dBm.

It is important to validate that the signal strength from both ends of the point-to-point link with very close RSSI values.

Cisco URWB IW9165DH Configurator
5.137.250.148 - MESH END MODE

ANTENNA ALIGNMENT AND STATS

Detected Links - Local Radio 1

Remote Unit	Remote Radio	Signal Strength	Alignment
5.137.250.80	1	-31 dBm (100%)	Align

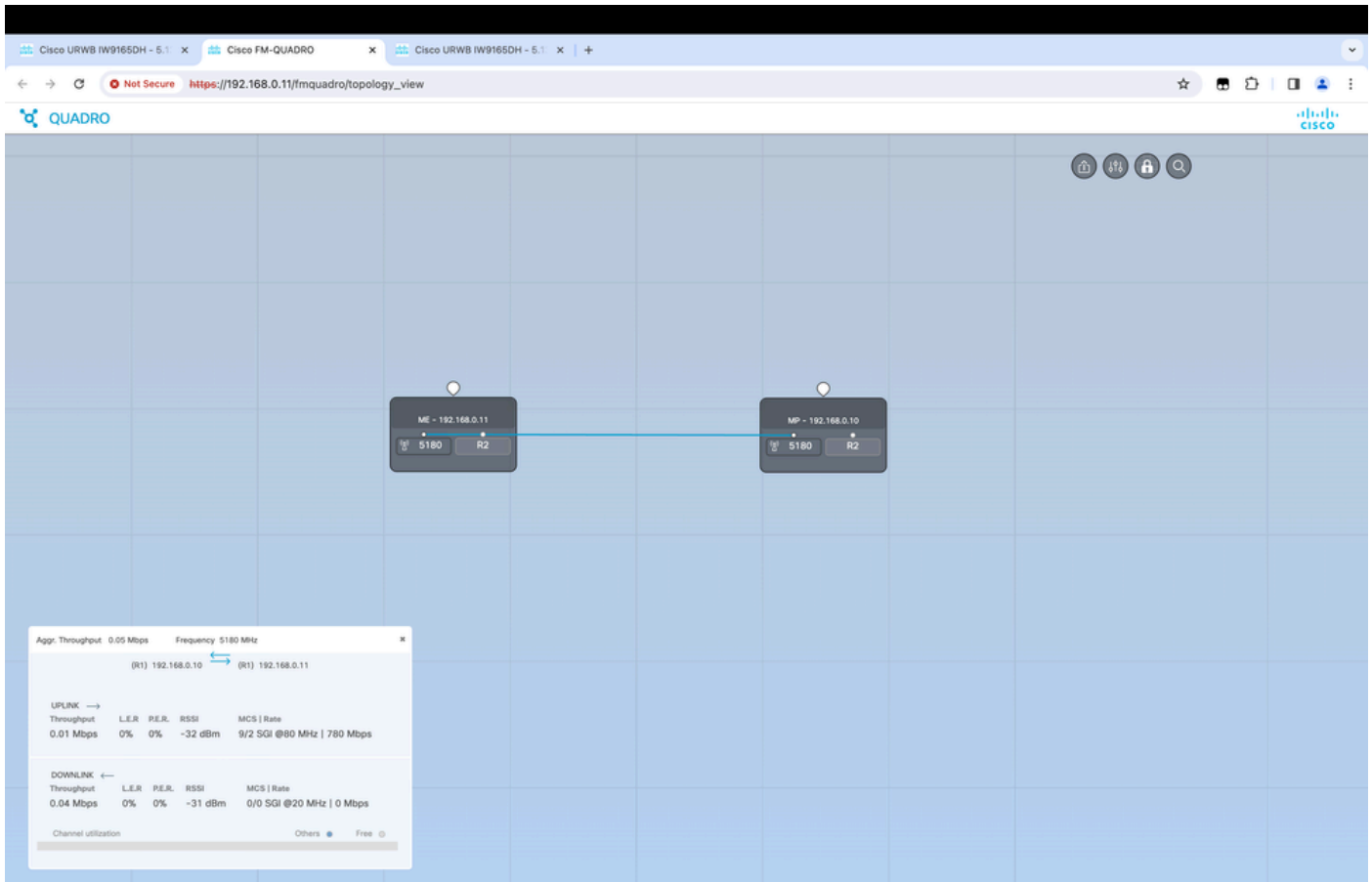
Detected Links - Local Radio 2

NO Link Available

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Monitoring from FM Quadro

Further details of the link performance can be obtained from the FM-Quadro page. This provides real-time quality of the link including Link Error Rate (LER), Packet Error Rate (PER), RSSI, Throughput MCS, Spatial stream, Operating frequency, and so on.



Fluidity

The Cisco Fluidity (formerly Fluidmesh Fluidity) network architecture is based on Prodigy 2.0. This is a Multiprotocol Label Switching (MPLS)- based technology used to deliver IP-encapsulated data.

In a Cisco Ultra-Reliable Wireless Backhaul mobility network scenario, the handoff process can be assimilated to a network topology change in which an existing link is broken and a new link is created. However, industry-standard mechanisms to detect the change and reconfigure the nodes are too slow and data-intensive to provide adequate performance within a constrained real-time scenario (such as highspeed mobility). In particular, reconfiguration latency and the number of messages exchanged need to be minimized to reduce any chance of data packets being lost in the process. To mitigate the previously mentioned issues, Fluidity implements a fast handoff solution that provides very fast path reconfiguration, with latency in the order of one millisecond. The active mechanism is an extension of the network's existing control plane and is based on a specific manipulation technique concerning the node MPLS FIB tables.

The Fluidity scheme allows mobile nodes and the client devices attached to them to maintain their IP address throughout the mobility process. In addition, all nodes are part of a single layer-2 mesh network.

Configuring Fluidity

Topology: Two IW9165D APs that are connected over wireless and IW9167 as a vehicle using Layer 2 Fluidity

1. Like the point-to-point link, we need to configure the General mode page. Note that the cluster of a CURWB L2 fluidity network has only one Mesh end. As in this network, there is no fiber connectivity between the two IW9165D. They are connected through a point-to-point wireless backhaul link with radio interface 1. The mesh end for this small fluidity network is the IW9165D that is physically

connected to the core network. All other radios in the cluster (including the vehicle) are then configured as a mesh point. In this topology, we have 1 mesh end and 1 mesh point that forms the point-to-point link and the IW 9167AP as a vehicle (configured as a mesh point).

- Radio 1 is configured for a point-to-point link and Radio 2 needs to be configured for Fluidity, for both trackside and vehicle radios. For vehicle radios, only one interface is configured with fluidity but the second radio is disabled.

The screenshot displays the Cisco URWB IW9165DH Configurator interface. The top left features the Cisco logo and the text "ULTRA RELIABLE WIRELESS BACKHAUL". The top right shows the device name "Cisco URWB IW9165DH Configurator" and the mode "5.137.250.148 - MESH END MODE".

The left sidebar contains a navigation menu with the following items:

- IOTOD IW (Offline)
- IW-MONITOR (Enabled)
- FM-QUADRO
- GENERAL SETTINGS
 - general mode
 - wireless radio
 - antenna alignment and stats
- NETWORK CONTROL
 - advanced tools
- ADVANCED SETTINGS
 - advanced radio settings
 - static routes
 - allowlist / blocklist
 - multicast
 - snmp
 - radius
 - ntp
 - ethernet filter
 - l2tp configuration
 - vlan settings
 - Fluidity
 - misc settings
 - smart license
- MANAGEMENT SETTINGS
 - remote access
 - firmware upgrade
 - status
 - configuration settings
 - reset factory default
 - reboot
 - logout

The main content area is titled "WIRELESS RADIO" and contains the following sections:

- Wireless Settings**: A text box for "Shared Passphrase" (masked with dots) and a "Show passphrase" checkbox. A note below states: "In order to establish a wireless connection between Cisco URWB units, they need to be operating on the same frequency."
- Radio 1 Settings**:
 - Role: Fixed
 - Frequency (MHz): 5180
 - Channel Width (MHz): 20
- Radio 2 Settings**:
 - Role: Fluidity
 - Frequency (MHz): 5745
 - Channel Width (MHz): 20

At the bottom of the main content area are "Reset" and "Save" buttons. The footer contains the copyright notice: "© 2023 Cisco and/or its affiliates. All rights reserved."

- From the Advanced Settings > Fluidity page, the trackside radios which provide coverage for the vehicles, need to be configured as Infrastructure. On the other side, the vehicle radio (IW 9167) needs to be configured as a vehicle.

IOTOD IW

Offline

IW-MONITOR

Enabled

FM-QUADRO

GENERAL SETTINGS

- general mode
- wireless radio
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NETWORK CONTROL

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ADVANCED SETTINGS

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MANAGEMENT SETTINGS

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- logout

FLUIDITY

Fluidity Settings

The unit can operate in 3 modes: Infrastructure, Infrastructure (wireless relay), Vehicle.

The unit must be set as Infrastructure when it acts as the entry point of the infrastructure for the mobile vehicles and it is connected to a wired network (backbone) which possibly includes other Infrastructure nodes. The unit must be set as Infrastructure (wireless relay) ONLY when it is used as a wireless relay agent to other Infrastructure units. In this operating mode, the unit MUST NOT be connected to the wired network backbone as it will use the wireless connection to relay the data coming from the mobile units.

The unit must be set as Vehicle when it is mobile. Vehicle ID must be set ONLY when the unit is configured as Vehicle. Specifically, Vehicle ID must be a unique among all the mobile units installed on the same vehicle. Unit installed on different vehicles must use different Vehicle IDs.

The Network Type field must be set according to the general network architecture. Choose Flat if the mesh and the infrastructure networks belong to a single layer-2 broadcast domain. Use Multiple Subnets if they are organized as different layer-3 routing domains.

Unit Role: Infrastructure

Network Type: Flat

The following advanced settings allow to fine-tune the performance of the system depending on the specific environment. Please do not alter this settings unless you have read the manual first and you know what you are doing.

The Handoff Logic controls the algorithm used by a mobile radio to select the best infrastructure point to connect to. In Normal mode, the point providing the strongest signal is selected. In Load Balancing mode, the mobile radio prefers the point which provides the best balance between signal strength and amount of traffic carried.

Handoff Logic: Standard

Reset

Save

IOTOD IW

Offline

IW-MONITOR

Enabled

GENERAL SETTINGS

- general mode
- wireless radio
- antenna alignment and stats

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

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MANAGEMENT SETTINGS

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FLUIDITY

Fluidity Settings

The unit can operate in 3 modes: Infrastructure, Infrastructure (wireless relay), Vehicle.

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The unit must be set as Vehicle when it is mobile. Vehicle ID must be set ONLY when the unit is configured as Vehicle. Specifically, Vehicle ID must be a unique among all the mobile units installed on the same vehicle. Unit installed on different vehicles must use different Vehicle IDs.

The Network Type filed must be set according to the general network architecture. Choose Flat if the mesh and the infrastructure networks belong to a single layer-2 broadcast domain. Use Multiple Subnets if they are organized as different layer-3 routing domains.

Unit Role:

Automatic Vehicle ID: Enable

Network Type:

The following advanced settings allow to fine-tune the performance of the system depending on the specific environment. Please do not alter this settings unless you have read the manual first and you know what you are doing.

The Handoff Logic controls the algorithm used by a mobile radio to select the best infrastructure point to connect to. In Normal mode, the point providing the strongest signal is selected. In Load Balancing mode, the mobile radio prefers the point which provides the best balance between signal strength and amount of traffic carried.

Handoff Logic:

Reset

Save

4. If using 2x2 MIMO, select the antenna number as ab-antenna.

- For the IW 9167, if using 2x2 MIMO and are using interface 1, use antenna ports 3 & 4. If configured for interface 2, use antenna ports 5 & 6.

- IOTOD IW** Offline
- IW-MONITOR** Enabled
-
- GENERAL SETTINGS
- general mode
 - wireless radio
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- ADVANCED SETTINGS
- advanced radio settings
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ADVANCED RADIO SETTINGS

Radio 1

FluidMAX Management

Force the FluidMAX operating mode of this unit. If the operating mode is Primary/Secondary a FluidMAX Cluster ID can be set. If the FluidMAX Autoscan is enabled, the Secondary units will scan the frequencies to associate with the Primary with the same Cluster ID. In this case, the frequency selection on the Secondarys will be disabled.

Radio Mode: OFF

Max TX Power

Select the max power level that the radio shall use to transmit (power level 1 sets the highest transmit power). The Cisco URWB TPC (Transmit Power Control) will automatically select the optimum transmission power according to the channel condition while not exceeding the MAX TX Power parameter. Note: in Europe TPC is automatically enabled.

Select TX Max Power:

Antenna Configuration

Select radio 1 antenna gain and antenna number.

Select Antenna Gain:

Antenna number:

Data Packet Encryption

Enable AES to cypher all wireless traffic. This setting must be the same on all the Cisco URWB units.

Enable AES:

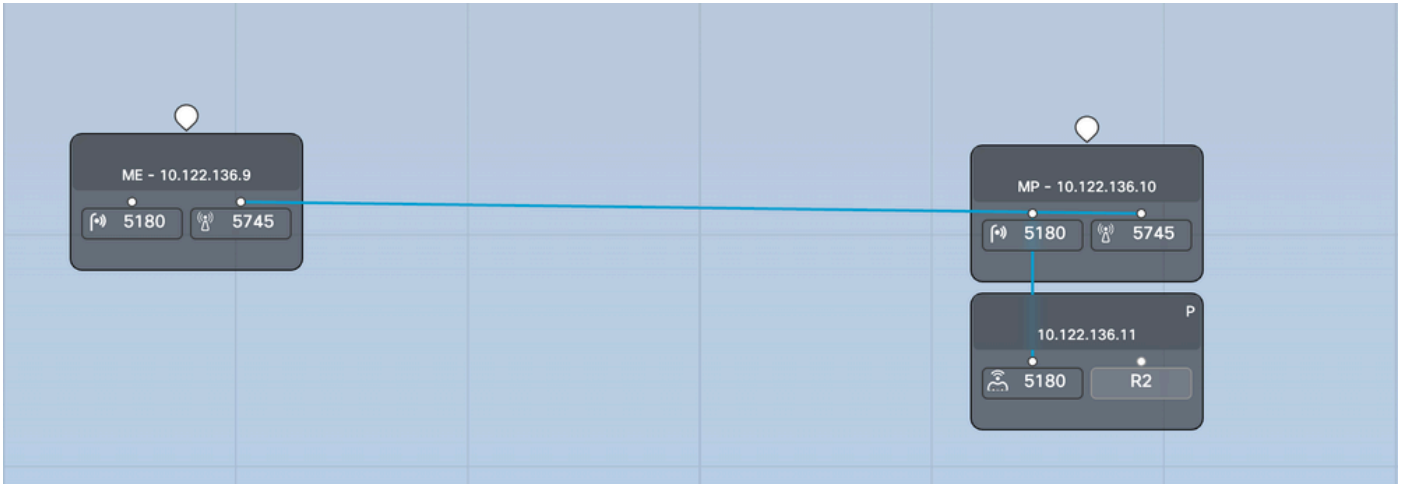
Maximum link length

Insert the length of the longest link in the net, or let the system select an optimal value.

Distance:

Unit: Km Miles

5. After configuring every setting, save the configuration, and at the end, apply the changes. APs reboot and, once the radios are back online, we are able to check RSSI from the Antenna alignment page and monitor the live connectivity from the FM-Quadro page.



Cisco URWB IW9167EH Configurator

5.246.2.120 - MESH POINT MODE

IOTOD IW

Offline

IW-MONITOR

Enabled

GENERAL SETTINGS

- general mode
- wireless radio
- antenna alignment and stats

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

- advanced radio settings

ANTENNA ALIGNMENT AND STATS

Detected Links - Local Radio 1

Remote Unit	Remote Radio	Signal Strength	Alignment
5.137.250.148	1	-67 dBm (100%)	Align
5.137.250.80	1	-52 dBm (100%)	Align

Detected Links - Local Radio 2

NO Link Available