

# Configure and Troubleshoot Layer 3 Fluidity on IW Access Points on URWB Mode

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## Introduction

This document describes the configuration of a Fluidity Layer 3 setup for CURWB devices and provides

practical guidance for troubleshooting the network.

The goal is to ensure a seamless setup process and to equip you with tools for resolving potential issues effectively.

## Components Used

The configuration detailed in this document involves these hardware components:

- Cisco Catalyst IW9167

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.

## What is Fluidity?

In the context of CURWB (Cisco Ultra-Reliable Wireless Backhaul), Fluidity is a network architecture built on Multiprotocol Label Switching (MPLS) technology, designed to deliver IP-encapsulated data efficiently.

In a CURWB mobility network, handoff processes occur when an existing link is broken, and a new link is established. This handoff resembles a network topology change, a critical challenge in high-speed mobility scenarios.

Conventional mechanisms for detecting such changes and reconfiguring nodes are often too slow and data-intensive, leading to suboptimal performance.

To overcome these limitations, Fluidity introduces a fast handoff solution that provides rapid path reconfiguration with latency as low as one millisecond. T

his mechanism enhances real-time performance in high-mobility scenarios by extending the network's control plane and leveraging a specialized manipulation technique for node MPLS Forwarding Information Base (FIB) tables.

In the Fluidity architecture, mobile nodes dynamically establish pseudo wires with trackside radios upon mutual detection.

As the vehicle moves along the track, it initiates handoff from one trackside radio to another based on predefined fluidity parameters, ensuring seamless connectivity and optimal performance

## Need for Layer 3 Fluidity

Layer 3 Fluidity offers a range of capabilities that address mobility challenges in multi-network environments. Key advantages include:

1. Seamless Handoff Across Subnets

Fluidity Layer 3 enables a vehicle to transition seamlessly between trackside base stations or radios that belong to different subnets.

2. L2TP Tunnel Integration

This seamless connectivity is achieved using Layer 2 Tunneling Protocol (L2TP) tunnels. These tunnels

connect the Mesh End at each network cluster or site to a centralized Fluidmesh Gateway device located at the network core, known as the Global Gateway.

### 3. Centralized MPLS Routing

Each Global Gateway establishes an L2TP tunnel with the Mesh End at every network cluster or subnet. This configuration allows MPLS routing to occur at the Global Gateway, eliminating the need for conventional Layer 3 routing at each subnet.

### 4. Uninterrupted Connectivity During Handoff

With Layer 3 Fluidity, vehicles can move between multiple trackside network clusters—each belonging to a different network or subnet—without losing end-to-end connectivity to the core network, even during handoff.

### 5. Scalability Across Wide-Area Deployments

Layer 3 Fluidity is designed to scale across multiple network deployments and sites, even those separated by significant distances. It works seamlessly whether the sites are connected via private fiber-optic links or across public domain infrastructure such as ISPs.

### 6. Flattening of Subnets for Seamless Routing

Fluidity Layer 3 operates on top of existing network infrastructures and "flattens" subnets using L2TP encapsulation. These encapsulations establish seamless routing and end-to-end connectivity for vehicles moving across multiple networks, all the way back to the core network.

## Fluidity Layer 3 Key Concepts

- Communication between trackside subnets and the Global Gateway network relies on the customer-routed IP network, while connectivity to vehicle networks is established through MPLS and L2TP tunnels.
- Each trackside radio network requires at least one Mesh End, with networks on separate broadcast domains.
- Each Global Gateway must connect to the L2TP WAN address of every Mesh End
- Vehicle-mounted CURWB radios must have static routes for each local subnet, enabling address advertisement back to the Global Gateway for network convergence.
- The onboard router's IP address must be set as the default gateway for vehicle radios

## Network Topology for Layer 3 Fluidity

This document outlines the architecture of a Cisco Ultra-Reliable Wireless Backhaul (CURWB) Layer 3 network design.

This robust topology is engineered to facilitate seamless and reliable communication between moving vehicles and a fixed trackside infrastructure, ultimately integrating data into a centralized corporate network.

The design leverages Layer 3 routing to segment the network logically, ensuring efficient data flow and scalability across distinct operational domains.

**Vehicle Segment:** Each "Vehicle" is equipped with an Onboard Router, an Onboard Switch, Onboard Servers, and two IW9167 devices, providing critical hardware redundancy.

The Onboard Router acts as the primary gateway for the vehicle's internal network, connecting to the

Onboard Switch, which in turn facilitates connectivity for the IW9167 devices and Onboard Servers.

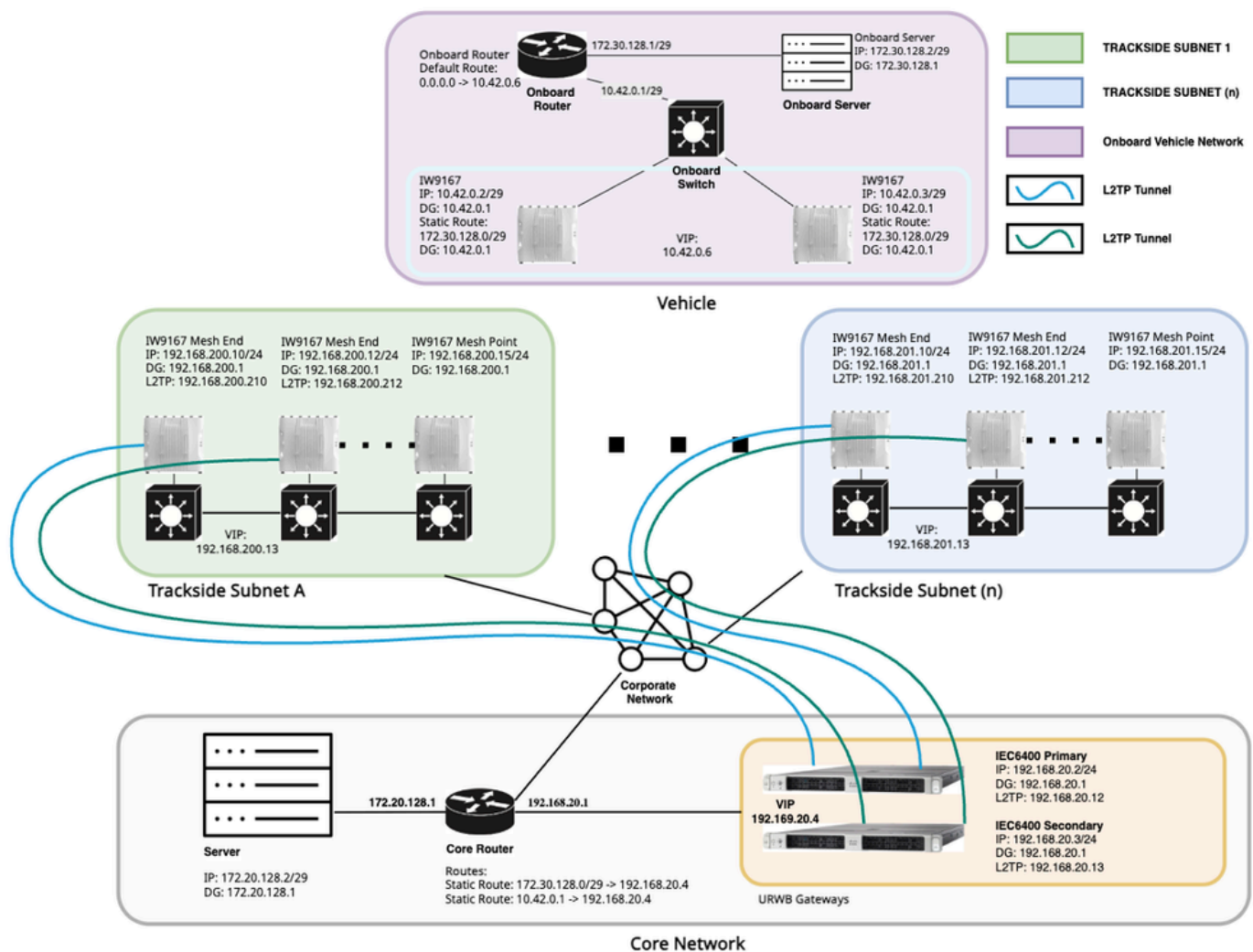
Trackside Subnets: The infrastructure includes multiple "Trackside Subnets" (for example, Trackside Subnet A, Trackside Subnet n), each comprising various IW9167 radios, including both Mesh End and Mesh Point devices.

Each Trackside Subnet is designed with two Mesh End devices at its ingress/egress point, implementing a "fastfail" feature for hardware redundancy.

This setup allows each subnet section to represent a distinct geographical area, enabling vehicles to roam seamlessly between these areas while maintaining continuous connectivity with the corporate network.

Corporate Network: This central network serves as the backbone, connecting to all Trackside Subnets and housing the core infrastructure. It comprises a Core Server, a Core Router, and redundant URWB Gateways (Primary and Secondary IEC6400 devices).

The Core Router is responsible for aggregating traffic from the various Trackside Subnets and managing static routes to ensure efficient communication between the corporate network and both the vehicle and Trackside segments.



## Network IP Configuration Summary

Component/Device	IP Address	Subnet	Default Gateway	L2TP Address	Notes
Vehicle Segment					
Onboard IW9167 (1)	10.42.0.2	255.255.255.248	10.42.0.1	NA	Static Route 172.30.128.0/29 > 10.42.0.1  VIP: 10.42.0.6
Onboard IW9167 (2)	10.42.0.3	255.255.255.248	10.42.0.1	NA	
Onboard Server	172.30.128.2	255.255.255.248	172.30.128.1	NA	
Onboard Router IW Interface	10.42.0.1	255.255.255.248			Default Route: 0.0.0.0 -> 10.42.0.6
Onboard Router Network Interface	172.30.128.1	255.255.255.248			
Trackside Segment (Subnet A)					
Mesh End IW9167 (1)	192.168.200.10	255.255.255.0	192.168.200.1	192.168.200.210	VIP 192.168.200.13
Mesh End IW9167 (2)	192.168.200.12	255.255.255.0	192.168.200.1	192.168.200.212	
Mesh Point IW9167	192.168.200.15	255.255.255.0	192.168.200.1		
Trackside Segment (Subnet B)					
Mesh End IW9167 (1)	192.168.201.10	255.255.255.0	192.168.201.1	192.168.201.210	VIP 192.168.201.13
Mesh End IW9167 (2)	192.168.201.12	255.255.255.0	192.168.201.1	192.168.201.212	
Mesh Point IW9167	192.168.201.15	255.255.255.0	192.168.201.1		

Core Network Segment					
Gateway IEC6400 (1)	192.168.20.2	255.255.255.0	192.168.20.1	192.168.20.12	VIP 192.168.20.4
Gateway IEC6400 (1)	192.168.20.3	255.255.255.0	192.168.20.1	192.168.20.13	
Core Router Gateway Interface	192.168.20.1	255.255.255.0			Static Route: 172.30.128.0/29 -> 192.168.20.4  Static Route: 10.42.0.1 -> 192.168.20.4
Core Router Trackside Subnet A Interface	192.168.200.1	255.255.255.0			
Core Router Trackside Subnet n Interface	192.168.201.1	255.255.255.0			
Core Router Server Interface	172.20.128.2	255.255.255.248	172.20.128.1		

## Configuring Layer 3 Fluidity

This document presents a basic Layer 3 configuration, highlighting only the essential settings required to establish connectivity between the core network and the vehicle network. Non-essential configurations and advanced features are not covered in this overview.

The configuration follows a design that incorporates hardware redundancy (FastFail) at Global Gateways, Local Mesh Ends, and Vehicle Radios, with the assumption that FastFail is already configured.

Notice that MPLS FastFail (HA) and VIP cannot be configured through the GUI and require the use of CLI or IW-Services. For detailed guidance on MPLS FastFail configuration, refer to this article:

<https://www.cisco.com/c/en/us/support/docs/wireless/ultra-reliable-wireless-backhaul/222196-configure-and-troubleshoot-titan-with-cu.html>

## Radio Configuration:

### Configuring Layer 3 Fluidity Via GUI:

#### Configuring Global Gateways:

##### 1. GENERAL SETTINGS > General Mode:


IEC6400, when configured as a Global Gateway, is designed to serve as the ingress and egress point for the CURWB Layer 3 network, enabling core-to-vehicle connectivity. Gateway operation for IEC6400 is

configured on the Fluidity page.

In contrast, when devices such as the IW9167 are used as a Global Gateway for a Layer 3 network, explicit gateway configuration is required on the General Mode page. Additionally, configuring IW radios in gateway mode disables the wireless interfaces, so the Radio-off mode must be set to Fluidity.

For the IEC-6400, the passphrase is configured on the General Mode page, whereas for other radios, it is set on the Wireless Radio page. It is essential to use the same passphrase for all trackside and vehicle devices to ensure connectivity.

The Local IP, Local Netmask, and Default Gateway for the device must be configured as required.

  
ULTRA RELIABLE  
WIRELESS BACKHAUL

Cisco URWB IEC-6400-URWB Configurator

5.69.163.198 - MESH END MODE

Sun 22 Jun 2025 11:53:05 AM HST

IOTOD IW

IW MONITOR

QUADRO

Offline

Disabled

GENERAL SETTINGS

- general mode

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

- static routes

- allowlist / blocklist

- multicast

- snmp

- radius

- ntp

- ethernet filter

- l2tp configuration

- vlan settings

- Fluidity

- misc settings

- smart license

MANAGEMENT SETTINGS

- remote access

- status

- configuration settings

- local certificate

- reset factory default

- reboot

- logout

GENERAL MODE

General Mode

"Mesh Passphrase" is an alphanumeric string or special characters excluding '[apex]' '[double apex]' '[backtick]' '\$[dollar]' '=' '[equal]' '\[backslash]' '<[left angle bracket]' '>[right angle bracket]' '#[hash]' '%[percent]' '([left bracket]' ')[right bracket]' '&[ampersand]' 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.

Mesh Passphrase:

••••••••

Show passphrase: ☐

LAN Parameters

Local IP:

192.168.20.2

Local Netmask:

255.255.255.0

Default Gateway:

192.168.20.1

Local Dns 1:

Local Dns 2:


Reset

Save

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## 2. ADVANCED SETTINGS > l2tp configuration:

On the L2TP configuration page, assign the L2TP WAN IP address within the same subnet as the gateway, and specify the WAN gateway as the gateway for this subnet. The local UDP port must be configured as 5701.

  
ULTRA RELIABLE  
WIRELESS BACKHAUL

Cisco URWB IEC-6400-URWB Configurator  
5.69.163.198 - MESH END MODE  
Sun 22 Jun 2025 12:15:25 PM HST

IOTOD IW  
IW MONITOR  
QUADRO

GENERAL SETTINGS  
- general mode  
NETWORK CONTROL  
- advanced tools  
ADVANCED SETTINGS  
- static routes  
- allowlist / blocklist  
- multicast  
- snmp  
- radius  
- ntp  
- ethernet filter  
- l2tp configuration  
- vlan settings  
- Fluidity  
- misc settings  
- smart license  
MANAGEMENT SETTINGS  
- remote access  
- status  
- configuration settings  
- local certificate  
- reset factory default  
- reboot  
- logout

Offline  
Disabled

Configuration contains changes. Apply these changes? [Discard](#) [Review](#) [Apply & Reboot](#)

### L2TP Configuration

**Local Unit Configuration**

WAN IP Address is local WAN IP address used for externally communicating with the remote tunnel peers. This address must be reachable from the external hosts, e.g. using port forwarding on the LAN gateway. WAN gateway is the local gateway used by the local unit to communicate with the outside world. Local UDP Port is the port used by remote peers to communicate with the local unit (0 means IP encapsulation).

☒ L2TP

WAN IP Address	WAN Netmask	WAN Gateway	Local UDP Port
<input type="text" value="192.168.20.12"/>	<input type="text" value="255.255.255.0"/>	<input type="text" value="192.168.20.1"/>	<input type="text" value="5701"/>

Max number of L2TP tunnels:

[Cancel](#) [Save](#)

**L2TP Tunnels**

L2TP Tunnels currently installed.

Remote IP Address	Remote UDP Port	Status	
192.168.200.210	5701	IDLE	<a href="#">del</a>

**Add a New L2TP Tunnel**

Remote WAN IP address corresponds to the WAN IP address of the REMOTE unit. Remote UDP port is the port number of the REMOTE unit (0 means IP encapsulation).


Remote WAN IP Address	Remote UDP Port	
<input type="text"/>	<input type="text"/>	<a href="#">Add</a>

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## 3. ADVANCED SETTINGS > Fluidity:

On the Fluidity page, Fluidity mode must be enabled. The IEC6400 Unit Role can only be configured as Infrastructure. For Layer 3 operation, the Network Type must be set to Multiple Subnets, and the Global

Gateway option must be selected.

  
ULTRA RELIABLE  
WIRELESS BACKHAUL

Cisco URWB IEC-6400-URWB Configurator  
5.69.163.198 - MESH END MODE  
Sun 22 Jun 2025 12:46:51 PM HST

IOTOD IWOffline

IW MONITORDisabled

QUADRO

GENERAL SETTINGS

- general mode

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

- static routes

- allowlist / blocklist

- multicast

- snmp

- radius

- ntp

- ethernet filter

- l2tp configuration

- vlan settings

- Fluidity

- misc settings

- smart license

MANAGEMENT SETTINGS

- remote access

- status

- configuration settings

- local certificate

- reset factory default

- reboot

- 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 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.

Fluidity ☒ Enable

Unit Role: Infrastructure

Network Type: Multiple subnets

Enable Global Gateway: ☒

Reset

Save


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# Configuring Trackside Radios

## 1. GENERAL SETTINGS > General Mode:

Configuration of the trackside radios is required next. Trackside radios may span multiple subnets, with radios under the same subnet forming a cluster. Each cluster must include dedicated Mesh End radios, which act as the ingress and egress point for that subnet of CURWB radios. One or two Mesh Ends can be configured, depending on whether high availability (HA) is required. The remaining trackside radios within the subnet must be configured as Mesh Points.

The Local IP, Local Netmask, and Default Gateway for the device must be configured as required.

  
ULTRA RELIABLE  
WIRELESS BACKHAUL

Cisco URWB IW9167EH Configurator

5.246.2.0 - MESH END MODE

Sun Jun 22 19:03:41 EDT 2025

IW Service

Offline

IW Monitor

Enabled

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

GENERAL MODE

General Mode

Select MESH END mode if you are installing this Cisco Catalyst IW9167E Heavy Duty 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:

Enable IPv6: ☐


Reset

Save

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## 2. GENERAL SETTINGS > Wireless Radio:

On the Wireless Radio page, it is essential to use the same passphrase as all other radios. The radio role for the wireless interface must be configured as Fluidity. While multiple wireless interfaces can be utilized for a radio based on project requirements, only Radio 1 is configured and Radio 2 is disabled in this lab setup for simplicity.



**Cisco URWB IW9167EH Configurator**  
5.246.2.0 - MESH END MODE  
Sun Jun 22 19:04:48 EDT 2025

**IW Service**  
**IW Monitor**  
**QUADRO**

Offline

Enabled

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

**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:
Fluidity

Frequency (MHz):
5180

Channel Width (MHz):
20

Radio 2 Settings

Role:
Disabled

Reset


Save

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### 3. ADVANCED SETTINGS > l2tp configuration:

On the L2TP configuration page, assign the L2TP WAN IP address within the same subnet as the gateway, and specify the WAN gateway as the gateway for this subnet. The local UDP port must be configured as 5701. This configuration is only required on mesh end radio(s) as Global gateway establishes the L2TP tunnel with the Mesh End radio(s) of each Subnet Clusters.

On the Fluidity page, Unit Role must be Infrastructure. For Layer 3 operation, the Network Type must be set to Multiple Subnets.



ULTRA RELIABLE  
WIRELESS BACKHAUL

Cisco URWB IW9167EH Configurator  
5.246.2.0 - MESH END MODE

Sun Jun 22 19:26:26 EDT 2025

IW Service

Offline

IW Monitor

Enabled

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

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 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: Infrastructure

Network Type: Multiple subnets

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

## Configuring Vehicle Radios

### 1. GENERAL SETTINGS > General Mode:

Configuration of the Vehicle radios is required next. Trackside radios may span multiple subnets, with radios under the same subnet forming a cluster. Each cluster must include dedicated Mesh End radios, which act as the ingress and egress point for that subnet of CURWB radios. One or two Mesh Ends can be configured, depending on whether high availability (HA) is required. The remaining trackside radios within the subnet must be configured as Mesh Points.

The Local IP, Local Netmask, and Default Gateway for the device must be configured as required.



ULTRA RELIABLE  
WIRELESS BACKHAUL

# Cisco URWB IW9165E Configurator

5.66.194.36 - MESH POINT MODE

Sun Jun 22 20:11:10 EDT 2025

IW Service

Offline

IW Monitor

Enabled

GENERAL SETTINGS

- general mode
- wireless radio
- antenna alignment and stats

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

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

MANAGEMENT SETTINGS

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

## GENERAL MODE

### General Mode

Select MESH POINT mode if you are attaching an IP edge device (i.e. network camera, encoder, etc.) to this Cisco IOT IW9165E Series Access Point or if you are using this unit as a relay point in the mesh network.

☒ mesh point
 

Mode:

☐ mesh end
 ☐ gateway

Radio-off:

☐

### LAN Parameters

Local IP:

Local Netmask:

Default Gateway:

Local Dns 1:

Local Dns 2:

Enable IPv6:

☐


Reset

Save

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## 2. GENERAL SETTINGS > Wireless Radio:

On the Wireless Radio page, it is essential to use the same passphrase as all other radios. The radio role for the wireless interface must be configured as Fluidity. While multiple wireless interfaces can be utilized for a radio based on project requirements, only Radio 1 is configured, and Radio 2 is disabled in this lab setup for simplicity.



ULTRA RELIABLE  
WIRELESS BACKHAUL

Cisco URWB IW9165E Configurator

5.66.194.36 - MESH POINT MODE

Sun Jun 22 20:01:16 EDT 2025

IW Service

Offline

IW Monitor

Enabled

GENERAL SETTINGS

- general mode

- wireless radio

- antenna alignment and stats

NETWORK CONTROL

- advanced tools

ADVANCED SETTINGS

- advanced radio settings

- static routes

- allowlist / blocklist

- snmp

- radius

- ntp

- ethernet filter

- l2tp configuration

- vlan settings

- Fluidity

- misc settings

MANAGEMENT SETTINGS

- remote access

- firmware upgrade

- status

- configuration settings

- reset factory default

- reboot

- logout

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: 

Fluidity

Frequency (MHz): 

5180

Channel Width (MHz): 

20

Radio 2 Settings

Role: 

Disabled

Reset

Save

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3. ADVANCED SETTINGS > static routes:

If the vehicle network includes multiple subnets for onboard devices or servers, a static route must be configured on the onboard radio. In this configuration, the onboard subnet and netmask must be specified, with the gateway set to the corresponding interface on the onboard router.



**Cisco URWB IW9165E Configurator**  
5.66.194.36 - MESH POINT MODE  
Sun Jun 22 20:09:49 EDT 2025

**IW Service** Offline  
**IW Monitor** Enabled

GENERAL SETTINGS  
- general mode  
- wireless radio  
- antenna alignment and stats  
NETWORK CONTROL  
- advanced tools  
ADVANCED SETTINGS  
- advanced radio settings  
- static routes  
- allowlist / blocklist  
- snmp  
- radius  
- ntp  
- ethernet filter  
- l2tp configuration  
- vlan settings  
- Fluidity  
- misc settings  
MANAGEMENT SETTINGS  
- remote access  
- firmware upgrade  
- status  
- configuration settings  
- reset factory default  
- reboot  
- logout

### STATIC ROUTES

Static routes

Add any remote subnet that does not belong to local networks

Subnet	Netmask	Gateway	
172.30.128.0	255.255.255.248	10.42.0.1	<span>del</span>

Add new static route

Subnet	Netmask	Gateway	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<span>add</span>

**Route added. Note: unable to install static route live, please double check current network configuration.**

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#### 4. ADVANCED SETTINGS > fluidity:

When configuring the vehicle radio, the Unit Role must be set to Vehicle. To enable Multiple Subnets as the Network Type, Automatic Vehicle ID must first be unchecked. Unique Vehicle IDs must be assigned to radios in each vehicle; however, if multiple radios are present on the same vehicle, the same Vehicle ID must be configured for all of them. Finally, set the Network Type to Multiple Subnets.

IW Service

Offline

IW Monitor

Enabled

#### GENERAL SETTINGS

- general mode
- wireless radio
- antenna alignment and stats

#### NETWORK CONTROL

- advanced tools

#### ADVANCED SETTINGS

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

#### MANAGEMENT SETTINGS

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

Vehicle ID:

Network Type: ☒ Flat

☐ Multiple subnets

The following advanced settings are available for the unit depending on the specific environment. Please do not alter these 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

Note:

While basic Layer 3 configuration can be performed through the GUI, configuring TITAN or VIP for mesh end devices requires the use of either the CLI or IW-Services, as these options are not available in the GUI.

## Configuring Layer 3 Fluidity Via IW-Services in IoT OD

### Configuring Global Gateways

1. In General Section, Mode must be selected as Global Gateway, and Shared Passphrase, Local IP address, Local Netmask and Default Gateway needs to be configured.

## Edit Device Configuration

Q Search

General

Multicast

SNMP

LLDP

Radius

NTP

L2TP

Vlan

Fluidity

Fluidity Advanced

Fluidity MPO

Misc

Spanning Tree

Ethernet Filter

QoS

MPLS

General

Mode

Global Gateway

Shared passphrase

URWB

Local IP Address

192.168.20.2

Local Netmask

255.255.255.0

Default Gateway

192.168.20.1

While configuring IW916X radios as Gateway, note that Radio Off will be automatically enabled, Radio Off mode needs to be Fluidity.

## Edit Device Configuration

Q Search

General

Wireless Radio

Advanced Radio Settings

Key Control

FluidMAX

Multicast

SNMP

Radius

NTP

L2TP

Vlan

Fluidity

Fluidity Advanced

Fluidity Pole Proximity

Fluidity Frequency Scan

Fluidity MPO

General

Mode

Gateway

Radio off

On

Radio off mode

Fluidity

Local IP Address

192.168.20.2

Local Netmask

255.255.255.0

Default Gateway

**2. In L2TP Section, WAN IP, WAN Netmask, WAN Gateway, ports. needs to be configured. At the same time L2TP Tunnels needs to be added.**

## Edit Device Configuration

Q Search

General

Multicast

SNMP

LLDP

Radius

NTP

**L2TP**

Vlan

Fluidity

Fluidity Advanced

Fluidity MPO

Misc

Spanning Tree

Ethernet Filter

QoS

MPLS

Enable L2TP

on

L2TP Interface

Ethernet1

WAN IP Address

192.168.20.12

WAN Netmask

255.255.255.0

WAN Gateway

192.168.20.1

Local UDP Port

5701

## Edit Device Configuration

Q Search

General

Multicast

SNMP

LLDP

Radius

NTP

**L2TP**

Vlan

Fluidity

Fluidity Advanced

Fluidity MPO

Misc

Spanning Tree

Ethernet Filter

QoS

MPLS

5701

Layer-3 MTU for the WAN interface

1480

L2TP Tunnels Number

6

L2TP Tunnels

Remote WAN IP Address

192.168.200.210

Remote UDP Port

5701

3. Finally, Fluidity needs to be enabled and Unit role must be Infrastructure, while network type must be multiple subnet.

## Edit Device Configuration

Q Search

General

Multicast

SNMP

LLDP

Radius

NTP

L2TP

Vlan

**Fluidity**

Fluidity Advanced

Fluidity MPO

Misc

Spanning Tree

Ethernet Filter

QoS

MPLS

Fluidity

Unit Role

Infrastructure

Network Type

Multiple subnet

Enable Primary Pseudowire Enforcement

Disable

### Configuring Trackside Radios:

1. In General Section, Mode must be selected as Mesh end, and Shared Passphrase, Local IP address, Local Netmask and Default Gateway needs to be configured.

Note: But for the mesh point trackside radios Mode will be Mesh point

## Edit Device Configuration

Q Search

General

Wireless Radio

Advanced Radio Settings

Key Control

FluidMAX

Multicast

SNMP

Radius

NTP

L2TP

Vlan

Fluidity

Fluidity Advanced

Fluidity Pole Proximity

Fluidity Frequency Scan

Fluidity MPO

Mode

Mesh End

Radio off

Off

Radio off mode

Parameter disabled

Local IP Address

10.122.136.50

Local Netmask

255.255.255.192

Default Gateway

10.122.136.1

2. In Wireless Radio Section, Passphrase, Radio Interface (which you want to use communicate to the vehicle), Frequency and passphrase needs to be configured

## Edit Device Configuration

Q Search

- General
- Wireless Radio
- Advanced Radio Settings
- Key Control
- FluidMAX
- Multicast
- SNMP
- Radius
- NTP
- L2TP
- Vlan
- Fluidity
- Fluidity Advanced
  - Fluidity Pole Proximity
  - Fluidity Frequency Scan
- Fluidity MPO

Wireless Radio

Passphrase

URWB

Radio 1 enabled

On

Radio 2 enabled

Off

Radio 1 role

Fluidity

Radio 2 role

Parameter disabled

Radio 1 Frequency (MHz)

5180 MHz

Radio 2 Frequency (MHz)

Parameter disabled

Radio 1 Channel width

20

Radio 2 Channel width

Parameter disabled

3. In L2TP Section, WAN IP, WAN Netmask, WAN Gateway, ports. needs to be configured. At the same time L2TP Tunnels needs to be added.

## Edit Device Configuration

Q Search

- General
- Wireless Radio
- Advanced Radio Settings
- Key Control
- FluidMAX
- Multicast
- SNMP
- Radius
- NTP
- L2TP
- Vlan
- Fluidity
- Fluidity Advanced
  - Fluidity Pole Proximity
  - Fluidity Frequency Scan
- Fluidity MPO

Enable L2TP

on

L2TP Interface

Ethernet1

WAN IP Address

192.168.200.210

WAN Netmask

255.255.255.0

WAN Gateway

192.168.200.1

Local UDP Port

5701

## Edit Device Configuration

Q Search

General

Wireless Radio

Advanced Radio Settings

Key Control

FluidMAX

Multicast

SNMP

Radius

NTP

**L2TP**

Vlan

Fluidity

Fluidity Advanced

Fluidity Pole Proximity

Fluidity Frequency Scan

Fluidity MPO

L2TP Tunnels Number

6

L2TP Tunnels

Remote WAN IP Address

192.168.20.12

Remote UDP Port

5701

Remote WAN IP Address

192.168.20.13

Remote UDP Port

5701

4. Finally, Fluidity needs to be enabled, and Unit role must be Infrastructure, while network type must be multiple subnet

## Edit Device Configuration

Q Search

General

Wireless Radio

Advanced Radio Settings

Key Control

FluidMAX

Multicast

SNMP

Radius

NTP

L2TP

Vlan

**Fluidity**

Fluidity Advanced

Fluidity Pole Proximity

Fluidity Frequency Scan

Fluidity MPO

Fluidity

Unit Role

Infrastructure

Automatic Vehicle ID

Parameter disabled

Vehicle ID

Parameter disabled

Network Type

Multiple subnet

Handoff Logic

Parameter disabled

Enable Primary Pseudowire

## Configuring Vehicle Radios

1. In General Section, Mode must be selected as Mesh end, and Shared Passphrase, Local IP address, Local Netmask and Default Gateway needs to be configured.

## Edit Device Configuration

Search

General

Wireless Radio

Advanced Radio Settings

Key Control

FluidMAX

Multicast

SNMP

Radius

NTP

L2TP

Vlan

Fluidity

Fluidity Advanced

Fluidity Pole Proximity

Fluidity Frequency Scan

Fluidity MPO

Mode

Mesh Point

Radio off

Off

Radio off mode

Parameter disabled

Local IP Address

10.42.0.2

Local Netmask

255.255.255.248

Default Gateway

10.42.0.1

2. In Wireless Radio Section, Passphrase, Radio Interface (which you want to use communicate to the trackside), Frequency and passphrase needs to be configured

## Edit Device Configuration

Search

General

Wireless Radio

Advanced Radio Settings

Key Control

FluidMAX

Multicast

SNMP

Radius

NTP

L2TP

Vlan

Fluidity

Fluidity Advanced

Fluidity Pole Proximity

Fluidity Frequency Scan

Fluidity MPO

Wireless Radio

Passphrase

CiscoURWB

Radio 1 enabled

On

Radio 2 enabled

Off

Radio 1 role

Fluidity

Radio 2 role

Parameter disabled

Radio 1 Frequency (MHz)

5180 MHz

Radio 2 Frequency (MHz)

Parameter disabled

Radio 1 Channel width

20

Radio 2 Channel width

Parameter disabled

3. Finally, Fluidity needs to be enabled, and Unit role must be Vehicle, and Vehicle ID must be manually selected while network type must be multiple subnet

## Edit Device Configuration

Q Search

- General
- Wireless Radio
- Advanced Radio Settings
- Key Control
- FluidMAX
- Multicast
- SNMP
- Radius
- NTP
- L2TP
- Vlan
- Fluidity
- Fluidity Advanced
- Fluidity Pole Proximity
- Fluidity Frequency Scan
- Fluidity MPO

Fluidity

Unit Role

Vehicle

Automatic Vehicle ID

Parameter disabled

Vehicle ID

1

Network Type

Multiple subnet

Handoff Logic

Standard

4. If the vehicle network includes multiple subnets for onboard devices or servers, a static route must be configured on the onboard radio. In this configuration, the onboard subnet and netmask must be specified, with the gateway set to the corresponding interface on the onboard router.

## Edit Device Configuration

Q Search

- Misc
- Spanning Tree
- MPLS
- Ethernet Filter
- Arp
- QoS
- Wi-Fi Multimedia Queues
- Ampdu
- TFTP
- Ethernet Settings
- GNSS
- SRCR RSSI Metric
- NAT Settings
- Telemetry
- Static Routes
- Allowlist/Blocklist
- VLAN Subnets

Static Routes

Subnet\*

172.30.128.0

Netmask\*

255.255.255.248

Gateway\*

10.42.0.1

## Configuring Layer 3 Fluidity Via CLI

This section outlines the CLI configuration for CURWB devices, based on the topology presented at the beginning of the article. It is assumed that FastFail redundancy is implemented at the Global Gateway, Trackside Mesh End, and Vehicle. For specific FastFail redundancy configuration steps, refer to the previously mentioned article. Only the VIP concept specific to Layer 3 Fluidity is covered here, with the assumption that FastFail has already been configured on all required radios.

### Configuring Global Gateways

Configure IEC6400 as Gateway

```
iotod-iw configure offline
```

```
### BASIC CONFIG ###
```

```
modeconfig passphrase URWB  
ip addr 192.168.20.2 netmask 255.255.255.0 gateway 192.168.20.1  
modeconfig layer 3 mode gateway  
l2tp wan 192.168.20.12 255.255.255.0 192.168.20.1 port 5701  
l2tp add 192.168.200.210 5701
```

```
### APPLY CONFIG ###
```

```
write  
reboot
```

## Configure AP radios as Gateway:

```
configure iotod-iw offline
```

```
### BASIC CONFIG ###
```

```
configure ap address ipv4 static 192.168.20.2 255.255.255.0 192.168.20.1  
configure modeconfig mode gateway  
configure modeconfig mode meshend radio-off fluidity  
configure wireless passphrase URWB  
configure fluidity id infrastructure  
configure l2tp wan 192.168.20.12 255.255.255.0 192.168.20.1  
configure l2tp port 5701  
configure l2tp add 192.168.200.210 5701  
mpls fastfail primary 192.169.20.4 // Set the virtual IP address of the redundant device group in
```

```
### APPLY CONFIG ###
```

```
write  
Reload
```

## Configuring Trackside Radios

```
configure iotod-iw offline
```

```
### BASIC CONFIG ###
```

```
configure ap address ipv4 static 192.168.200.10 255.255.255.0 192.168.200.1  
configure modeconfig mode meshend //Applicable for only Mesh End Trackside Radio  
configure modeconfig mode meshpoint //Applicable for only Mesh point Trackside Radio  
configure wireless passphrase URWB  
configure dot11Radio 1 enable  
configure dot11Radio 1 channel 149  
configure dot11Radio 1 band-width 20  
configure dot11Radio 1 antenna ab-antenna
```

```

configure dot11Radio 1 antenna gain 10
configure dot11Radio 1 txpower-level AUTO
configure dot11Radio 1 mode fluidity
configure dot11Radio 2 disable
mpls fastfail primary 192.168.200.13 // Set the virtual IP address of the redundant device group in Layer-3
configure modeconfig mode meshend mpls layer 3 //Applicable for only Mesh End Trackside Radio
configure modeconfig mode meshpoint mpls layer 3 //Applicable for only Mesh point Trackside Radio
configure fluidity id infrastructure

## L2TP CONFIG ## //Applicable only to the mesh end Trackside radios

configure l2tp wan 192.168.200.210 255.255.255.0 192.168.200.1
configure l2tp port 5701
configure l2tp add 192.168.20.12 5701
configure l2tp add 192.168.20.13 5701

### APPLY CONFIG ###

write
Reload

```

## Configuring Vehicle Radios.

```

configure iotod-iw offline

### BASIC CONFIG ###

configure ap address ipv4 static 10.42.0.2 255.255.255.248 10.42.0.1
configure modeconfig mode meshpoint
configure wireless passphrase URWB
configure dot11Radio 1 enable
configure dot11Radio 1 channel 149
configure dot11Radio 1 band-width 20
configure dot11Radio 1 antenna ab-antenna
configure dot11Radio 1 antenna gain 10
configure dot11Radio 1 txpower-level AUTO
configure dot11Radio 1 mode fluidity
configure dot11Radio 2 disable
configure modeconfig mode meshpoint mpls layer 3
configure fluidity id vehicle-id 1
configure ip route add 172.30.128.0 255.255.255.248 10.42.0.1
mpls fastfail primary 10.42.0.6 // Set the virtual IP address of the redundant device group in Layer-3

### APPLY CONFIG ###

write
Reload

```

## Switch/Router Configuration:

### Core Router Configuration:

```
configure terminal
ip route 172.30.128.0 255.255.255.248 192.168.20.4
ip route 10.42.0.1 255.255.255.248 192.168.20.4
exit
write
```

## **Onboard Router Configuration:**

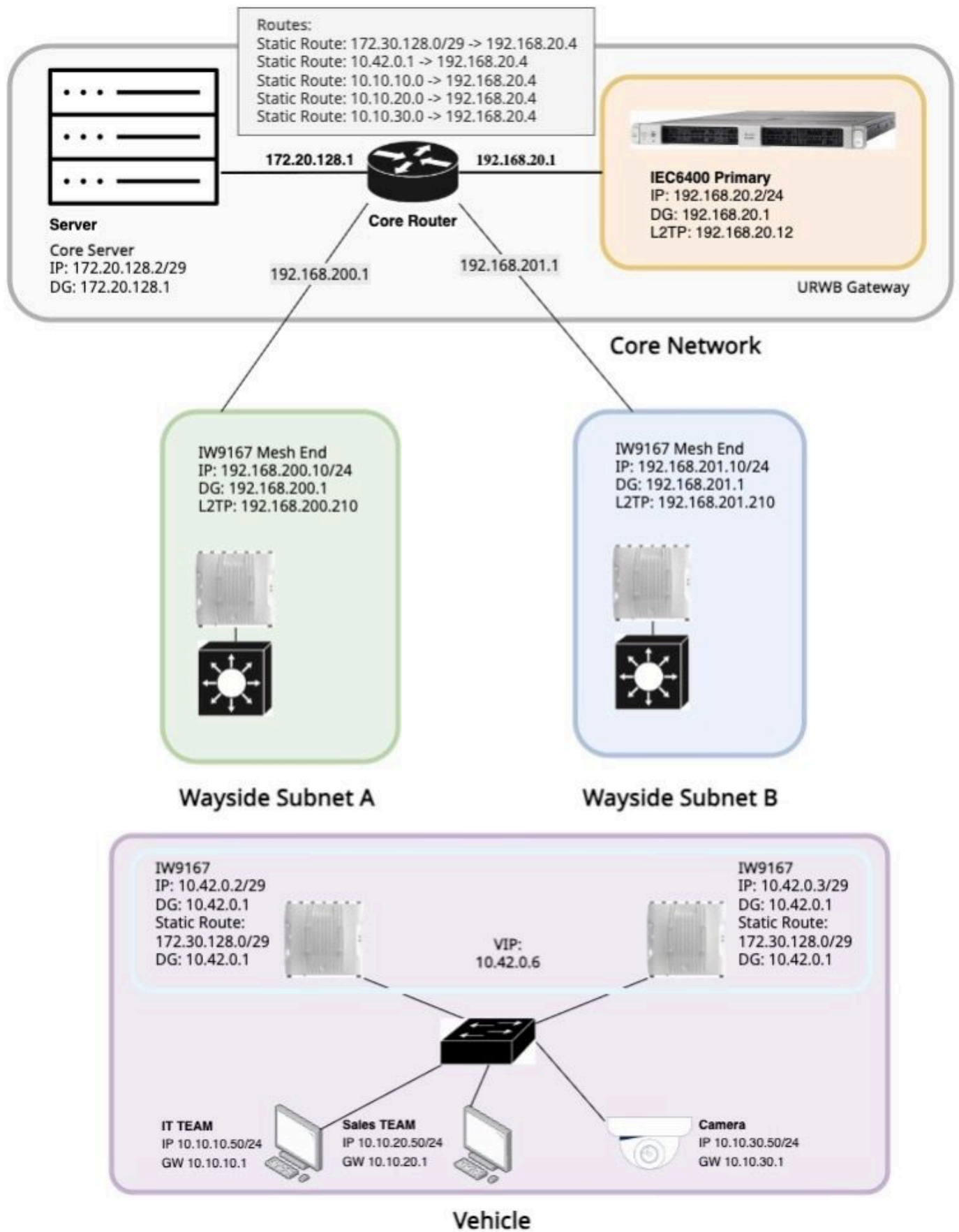
```
configure terminal
ip route 0.0.0.0 0.0.0.0 10.42.0.6
exit
write
```

# **CURWB L3 Variations for Onboard network**

## **Onboard Managed L2 Switch and No Router**

- This configuration describes a hybrid Layer 3 network environment in which trunked VLANs are present on moving vehicles.
- It is intended for vehicle units that do not have an onboard router.
- In this setup:
- VLANs must be configured on the onboard vehicle radio.
- VLAN functionality must be disabled on all infrastructure units and global gateways.
- This approach helps maintain connectivity between local subnets and the core network.
- Note: In this application, onboard radios do not replace the Layer 3 device that is typically responsible for inter-VLAN routing in standard Fluidity Layer 3 topologies.

## **Variation of Network Topology for Layer 3 Fluidity with no Onboard Router**



**Configuration of the Onboard Switch**

Switch#show vlan brief

VLAN	Name	Status	Ports
1	default	active	Gi1/0/3, Gi1/0/6, Gi1/0/7 Gi1/0/8, Gi1/0/9, Gi1/0/10 Gi1/0/13, Gi1/0/22
10	IT	active	Gi1/0/16
20	SALES	active	Gi1/0/17
30	CAMERA	active	Gi1/0/18
1002	fddi-default	act/unsup	
1003	token-ring-default	act/unsup	
1004	fddinet-default	act/unsup	
1005	trnet-default	act/unsup	

Switch #show interfaces trunk

Port	Mode	Encapsulation	Status	Native vlan
Gi1/0/23	on	802.1q	trunking	100
Gi1/0/24	on	802.1q	trunking	100

Port	Vlans allowed on trunk
Gi1/0/23	1-4094
Gi1/0/24	1-4094

Port	Vlans allowed and active in management domain
Gi1/0/23	1,10,20,30,60,100
Gi1/0/24	1,10,20,30,60,100

Port	Vlans in spanning tree forwarding state and not pruned
Gi1/0/23	1,10,20,30,60,100
Gi1/0/24	1,10,20,30,60,100

## Configuration of the Onboard Radio

- VLAN must be enabled only on the Vehicle units with no on-board router.

```
configure vlan status enabled
configure vlan management 60
configure vlan native 60
```

- It's important to add the static routes so the vehicle units can advertise the local subnets to the Global Gateways. The gateway for the subnets is the virtual IP used for the 2 on-board radios. In case of a single radio, the IP address of that radio must be used as the gateway.

```
configure ip route add 10.10.10.0 255.255.255.0 10.42.0.6
configure ip route add 10.10.20.0 255.255.255.0 10.42.0.6
configure ip route add 10.10.30.0 255.255.255.0 10.42.0.6
```

## Configuration of the Core Router

```
configure terminal
ip route 10.10.10.0 255.255.255.0 192.168.20.4
ip route 10.10.20.0 255.255.255.0 192.168.20.4
ip route 10.10.30.0 255.255.255.0 192.168.20.4
exit
write
```

## CURWB Layer 3 Network Troubleshooting:

In a Fluidity L3 network scenario, the L2TP tunnels status is one of the most important settings to check; in fact, a L2TP tunnel toward a cluster that is in IDLE or WAIT status or not properly configured, prevents the communication between the vehicle and backbone when the vehicle is connected to that specific cluster.

A simple way to check the tunnel status would be either to go on CLI and run “show l2tp” or from GUI check the status.

## L2TP Tunnel Verification

- L2TP page shows the current L2TP tunnels and their status (CONN, WAIT, IDLE).
- When both Mesh End's are up and running, on primary Mesh End the L2TP status will be in status CONN while on secondary Mesh End the L2TP status will be in status IDLE. If there connectivity issue in the Tunnel due to misconfiguration or physical issue, it will be at WAIT
- From here it's possible to check the current status and remove the L2TP tunnels already installed if needed.
- WAN IP address is unique to each device's L2TP configuration and must be different from the device's management IP address.

## L2TP Status Summarization

- Each Global Gateway establishes a L2TP tunnel with each remote Mesh End
- Each cluster Mesh End establishes a L2TP tunnel with the Global Gateways

With the system in normal condition (all devices up and running), this is the expected scenario between the global gateways and each L3 Fluidity trackside cluster:

- L2TP Tunnel between Primary Global Gateway and Primary Mesh End – CONN
- L2TP Tunnel between Primary Global Gateway and Secondary Mesh End – IDLE
- L2TP Tunnel between Secondary Global Gateway and Primary Mesh End – IDLE
- L2TP Tunnel between Secondary Global Gateway and Secondary Mesh End – IDLE

## Typical Configuration Issues / Things to Check

- Use of the same IP, WAN IP, or Virtual IP on multiple interfaces of the same device.
- Incorrect remote IP address configured; device is pointing to an IP that is not the correct WAN IP of the remote device.
- Duplicated WAN IP; two Mesh Ends within the same cluster are configured with the same WAN IP.

- Tunnel configured to establish over an Ethernet port that is not connected to the network.
- UDP port mismatch; local device and remote peer are using different UDP ports for traffic encapsulation.