



# CHAPTER 5

## Introduction to Radio Aware Routing and MANET

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After configuring the interfaces and verifying connectivity as described in [Chapter 3, “Configuring the Interfaces,”](#) you will need to configure each interface with the appropriate protocol.

This chapter provides the following major sections to describe Radio Aware Routing (RAR) for use in a Mobile Ad-hoc Network (MANET):

- [Introduction to RAR, page 5-1](#)
- [MANET Protocols, page 5-2](#)
- [Understanding Virtual Templates, page 5-2](#)
- [Configuring QoS, page 5-3](#)

### Introduction to RAR

The Radio Aware Routing (RAR) strategy relies on a hierarchy of routing interfaces. At the top-most level is the Virtual Multipoint Interface, or VMI. The VMI provides a single, unified representation of the MANET to routing protocols (OSPFv3 or EIGRP), and to the rest of the attached topology.

For traffic originating outside the MANET, the VMI represents the ingress and egress point to and from the MANET. As traffic comes into the router, destined for the MANET, the router passes the traffic to the VMI interface. The VMI, in turn, fans the traffic out (based on destination) to the correct Virtual-Access interface, where QoS policy can be applied to queue the traffic based on the radio characteristics of the next hop. After applying (potentially different) QoS parameters on the Virtual-Access interfaces, the Virtual-Access interface funnels the traffic to the physical interface for transmission to the radio device.

The Virtual-Access interfaces are logically “underneath” the VMI interface. Each Virtual-Access interface represents a “destination” which is either a routing next-hop, or a multicast group. The QoS logic and associated queues on the Virtual-Access interfaces facilitate the fine-grained QoS. The Virtual-Access interface that exists for each next-hop or group gives the ability to vary QoS behavior on a hop-by-hop (or group-by-group) basis.

At the bottom of the interface hierarchy is the actual physical interface connecting the router and radio.

# MANET Protocols

The protocols described in this guide support Mobile Ad-hoc Networks (MANETs). MANET-routing protocols provide signaling among MANET routers, including scope-limited flooding and point-to-point delivery of MANET routing protocol signaling in a multi-hop network. Packets may be unicast or multicast and use any appropriate transport protocol.

The RAR protocols supported Cisco IOS Release 15.2(1)GC provide the capabilities listed in [Table 5-1](#).

**Table 5-1** RAR Protocols

Feature	RFC 5578	Dynamic Link Exchange Protocol (DLEP)
Transport	Point-to-Point Protocol over Ethernet (PPPoE)	UDP
Packet Transport	Point-to-Point Point to Multipoint	Broadcast Multi-access
Flow Control	Credit or Rate-based	Rate-based
Convergence Events	Yes	Yes
Metrics	Defined in RFC 5578	Same metrics as RFC 5578
Modem Support	Split-stack PPPoE to router	UDP to router Transparent bridge on data path
RFC Status	Informational	Standards-track (submitted, not yet approved)
Supports Modem Multiple Hops from Router	No, PPPoE discovery is broadcast	Yes
Open Source	Available for client only	Available for both client and server
See Chapter	<a href="#">Chapter 8, “Configuring PPPoE”</a>	<a href="#">Chapter 6, “Understanding and Configuring DLEP”</a>

[Table 5-2](#) lists the routing protocols that support RAR and MANET:

**Table 5-2** Routing Protocols that Support RAR and MANET

Routing Protocol	See Chapter
Open Shortest Path First, Version 3 (OSPFv3)	<a href="#">Chapter 10, “Configuring OSPFv3 for a MANET”</a>
Enhanced Interior Gateway Routing Protocol (EIGRP)	<a href="#">Chapter 11, “Configuring EIGRP in a MANET”</a>

## Understanding Virtual Templates

Each RAR protocol requires a virtual template. The virtual template is used to create Virtual-Access interfaces. All Virtual-Access interfaces inherit the attributes of the virtual template. When configuring each RAR protocol, you will assign a virtual-template number. To configure virtual templates for each RAR protocol, see the chapter in this manual on the specific protocol.

# Configuring QoS

When using RAR, QoS is applied at the Virtual-Access interfaces. Defining and enforcing QoS profiles is configured on a next-hop basis. Traffic prioritization to one peer system should not impact traffic prioritization to other peers.

Configuring Quality of Service (QoS) varies per protocol:

- MQC—For RFC 5578, DLEP, and Modular QoS CLI (MQC) configurations are supported. Full MQC configurations include remarking, shaping, and policing.
- CDR-based QoS—For DLEP and QoS configuration is based entirely on Current Data Rate (CDR) shaping.

For more information about CDR-based QoS configurations, see [CDR-based QoS, page 5-3](#).

## QoS Configuration Types

Configuring Quality of Service (QoS) can follow one of various approaches:

- [CDR-based QoS, page 5-3](#)
- [Standard IOS QoS, page 5-3](#)

## CDR-based QoS

The only QoS configuration required for DLEP or R2CP is the shaping definition. When DLEP or R2CP detects a new neighbor, a set of metrics is exchanged from radio to router. These metrics include a Current Data Rate (CDR) value. When configuring rate-based shaping, the router shapes the traffic destined for each neighbor based on its CDR rate.

### Reporting CDR Values

When using rate-based shaping, the parent policy includes a percent value for the shaping command. This allows the radio to report a different CDR value and the shaping to adapt to the new value on the router. While you can use a static bandwidth on the shaping command, it may not represent the link properly, resulting in traffic that can queue unpredictably.

### Traffic Queues

Traffic queues are based on the child policy-map while the parent policy-map shapes the traffic. Most of the configuration is a normal hierarchical configuration.

For more information on normal hierarchical configuration, go to the following URL:  
[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos\\_mqc\\_ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos_mqc_ps6441_TSD_Products_Configuration_Guide_Chapter.html)

## Standard IOS QoS

Standard QoS configuration requires the following:

1. [Traffic Class Configuration, page 5-4](#)
2. [Policy Map Configuration, page 5-4](#)

### 3. Policy Assignment, page 5-4

For general information on configuring QoS, go to the following URL:  
[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos\\_mqc.pdf](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos_mqc.pdf)

## Traffic Class Configuration

You must configure traffic classes for QoS. Traffic classes contain a traffic class name, a match command, and instructions on how to evaluate match commands. Once configured, you can assign the QoS policy to the Virtual-Access interface.

For information on how to configure classes, refer to the following URL:  
[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos\\_mqc.ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html#wp1058823](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos_mqc.ps6441_TSD_Products_Configuration_Guide_Chapter.html#wp1058823)

## Policy Map Configuration

You must configure policy maps for QoS. After configuring policies, you can attach the policies to a Virtual-Access interface.

For information on how to configure policies, refer to the following URL:  
[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos\\_mqc.ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html#wp1059601](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos_mqc.ps6441_TSD_Products_Configuration_Guide_Chapter.html#wp1059601)

## Policy Assignment

After configuring traffic classes and policy maps, you can assign policies to the virtual interface. You assign policies to the Virtual-Access interface to apply QoS shaping to the previously created virtual template. Policies are applied to every peer that the RAR protocol creates.

For information on how to assign policies to the virtual template, refer to the following URL:  
[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos\\_mqc.ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html#wp105970](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/qos_mqc.ps6441_TSD_Products_Configuration_Guide_Chapter.html#wp105970)