Air Time Fairness

This chapter explains how to configure and verify Cisco's airtime allocation feature, covering policy creation, RF profile settings, enforcement versus monitor modes, CLI/GUI procedures, deployment use cases, limitations, and verification commands.

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Air time fairness

Cisco Air Time Fairness (ATF) is a WLAN management feature that

- allocates Wi-Fi air time for user groups or device categories
- allows network administrators to group devices of a defined category and enables some groups to receive traffic from the WLAN more frequently than other groups
- provides air time fairness defined by the network administrator and not by the network, and
- dynamically adapts to changing conditions in a WLAN.

Air time fairness capabilities

Cisco ATF provides these additional capabilities:

- Provides a simplified mechanism for allocating air time.
- Enables a more efficient fulfillment of service-level agreements.
- Augments standards-based Wi-Fi QoS mechanisms.

By enabling network administrators to define what fairness means in their environments with regards to the amount of air time per client group, the amount of traffic is also controlled.

To control air time on a percentage basis, the air time including both uplink and downlink transmissions of a client or SSID is continuously measured.

Only air time in the downlink direction, that is AP to client, can be controlled accurately by the AP. Although air time in the uplink direction, that is client to AP can be measured, it cannot be controlled. Although the AP can constrain air time for packets that it sends to clients, the AP can only measure air time for packets that it hears from clients because it cannot strictly limit their air time.

Cisco ATF establishes air time limits (defined as a percentage of total air time) and applies those limits on a per SSID basis, where the SSID is used as a parameter to define a client group. Other parameters can be used as well to define groups of clients. Furthermore, a single air time limit can be applied to individual clients.

If the air time limit for an SSID (or client) is exceeded, the packets in the downlink direction are dropped. Dropping downlink packets (AP to client) frees up air time whereas dropping uplink packets (client to AP) does not do anything to free up air time because the packet has already been transmitted over the air by the client.

Client fair sharing ensures that all clients in an SSID or WLAN are treated equally based on their utilization of the radio bandwidth:

- The percentage of air time to be given to each client is recomputed every time a client connects or disconnects.
- Client fair sharing is applicable only to downstream traffic.
- Clients can be categorized into usage groups at the policy level.
- Client-based ATF metrics accumulation is performed in the transmit complete routine. This allows the air time that is unused by clients in low-usage or medium-usage groups to be accumulated to a common share pool bucket where the high-usage clients can be replenished.

Cisco ATF is supported on the following APs:

- Cisco Aironet 2700 Series Access Points
- Cisco Aironet 3700 Series Access Points
- Cisco Aironet 2800 Series Access Points
- Cisco Aironet 3800 Series Access Points
- Cisco Aironet 4800 Series Access Points
- Cisco Aironet 1540 Series Access Points
- Cisco Aironet 1560 Series Access Points

Note Cisco ATF is supported on MESH, if APs support ATF. ATF is supported on FlexConnect mode and the Local mode.

Note Cisco Catalyst APs offer capabilities that are equivalent to ATF by leveraging the enhancements in the Wi-Fi 6 and 6E protocols. 802.11ax features such as OFDMA, bidirectional MU-MIMO, and BSS coloring, combined with the advanced QoS features in the Cisco Catalyst 9800 Series Wireless Controllers, help resolve scheduling and congestion problems, accommodate multiple users at the same time, and allocate bandwidth more efficiently.

Cisco ATF operates in the following modes:

- Monitor mode: View the air time, report air time usage for all AP transmissions, view reports per SSID or WLAN, view reports per site group/tag, report air time usage at periodic intervals. No enforcement as part of Monitor mode.

- Enforce Policy mode: Enforce air time based on configured policy, enforce air time on a WLAN, all APs connected in a Cisco Catalyst 9800 Series Wireless Controller network, or per site group/tag.

Restrictions on Cisco air time fairness

This reference provides the specific restrictions that apply when implementing and configuring Cisco Air Time Fairness (ATF) functionality.

- Cisco ATF can be implemented only on data frames in the downstream direction.
- When ATF is configured in per-SSID mode, all the WLANs are disabled before you enter any ATF configuration commands. The WLANs are enabled after you enter all the ATF commands.

Cisco air time fairness use cases

A Cisco Air Time Fairness use case is a deployment scenario that

- demonstrates how air time allocation can be partitioned between different user groups or service providers in shared WLAN environments
- addresses specific network sharing requirements in venues such as public hotspots, educational institutions, enterprises, and managed hotspot services, and
- enables fair distribution of wireless bandwidth resources based on business or operational requirements.

Common ATF deployment scenarios

The following scenarios illustrate typical ATF implementations across different environments:

- **Public hotspots (stadium/airport/convention center/other)**: A public network is sharing a WLAN between two (or more) service providers and the venue. Subscribers to each service provider can be grouped and allocated a certain percentage of air time.
- **Education**: A university is sharing a WLAN between students, faculty, and guests. The guest network can be further partitioned by the service provider, for distribution of bandwidth privileges to the guests. Each group can be assigned a certain percentage of air time.
- **Enterprise/hospitality/retail**: The venue is sharing a WLAN between employees and guests. The guest network can be further partitioned by service provider. The guests could be sub-grouped by tier of service type with each subgroup being assigned a certain percentage of air time, for example a paid group is entitled for more air time than the free group.
- **Time shared managed hotspot**: The business entity managing the hotspot, such as a service provider or an enterprise, can allocate and subsequently lease air time to other business entities.

Configure Cisco air time fairness

Summary

The key components involved in configuring Cisco Air Time Fairness are:

- Monitor mode: Optional network usage determination tool

- Cisco ATF policies: Configuration rules that define air time allocation
- WLAN ATF policy assignment: Network or site group/tag level policy application
- Optimization settings: Performance enhancement configurations
- ATF statistics monitoring: Ongoing performance tracking and validation

Workflow

The configuring Cisco Air Time Fairness process involves these stages:

1. Enable Monitor mode to determine network usage.
2. Create Cisco ATF policies.
3. Add WLAN ATF policies per network or per site group/tag.
4. Determine, if optimization must be enabled.
5. Periodically check the Cisco ATF statistics.

Create a Cisco ATF profile (GUI)

Before you begin

Follow these steps to create a Cisco ATF profile using the GUI:

Procedure

Step 1 Choose **Configuration** > **Wireless** > **Air Time Fairness**.

Step 2 Click the **Profiles** tab and click the **Add** button, to create a new ATF policy.

The **Add ATF Policy** window is displayed.

Step 3 Specify a name, ID, and weight to the ATF policy.

Weighted ratio is used instead of percentages so that the total can exceed 100. The minimum weight that you can set is 5. For example, if you configure the weight as 50, this means that the air time for this ATF profile is 50% when applied to an policy profile.

Step 4 Use the slider to enable or disable the **Client Sharing** feature.

When you enable this option in the Web UI, the default ATF configuration is set to **Enforce** and not **Monitor**.

Step 5 Click **Apply to Device**.

Create Cisco ATF profile (CLI)

Create and configure a Cisco ATF (Airtime Fairness) profile to manage airtime allocation and ensure fair distribution of wireless resources among clients.

Cisco ATF profiles are used to control how airtime is allocated among wireless clients on an access point. This helps ensure that slower clients do not monopolize airtime at the expense of faster clients, improving overall network performance.

Procedure

Step 1 Enter global configuration mode.

Example:

```
Device# configure terminal
```

Step 2 Create a new Cisco ATF policy.

Example:

```
Device(config)# wireless profile airtime-fairness atf-policy-name atf-profile-id
```

Example:

```
Device(config)# wireless profile airtime-fairness atf-policy-name 1
```

- *atf-policy-name*—Enters the ATF profile name.
- *atf-profile-id*—Enters the ATF profile ID. Range is from 0 to 511.

Step 3 Add a weight to the Cisco ATF policy.

Example:

```
Device(config-config-atf)# weight policy-weight
```

Example:

```
Device(config-config-atf)# weight 5
```

- *policy-weight*—Enters the policy weight. Range is from 5 to 100.

Step 4 Enable client sharing for Cisco ATF policy.

Example:

```
Device(config-config-atf)# client-sharing
```

Step 5 Return to privileged EXEC mode.

Example:

```
Device(config-config-atf)# end
```

Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

The Cisco ATF profile is created and configured with the specified weight and client sharing settings, ready to be applied to wireless policies for airtime management.

Attach Cisco ATF profile to a policy profile (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **Policy**.

Step 2 Click **Add**.

The **Add Policy Profile** window is displayed.

Step 3 Click the **Advanced** tab.

Step 4 Under the **Air Time Fairness Policies** section, select the required policy for 2.4 GHz and 5 GHz policies.

Step 5 Click **Apply to Device**.

Attach Cisco ATF profile to a policy profile (CLI)

Attach a Cisco ATF profile to a policy profile to enable airtime fairness management for wireless clients.

This procedure is used when you need to associate an existing ATF policy with a policy profile to control airtime allocation across wireless clients on specific radio bands.

Procedure

Step 1 Enter global configuration mode.

Example:

```
Device# configure terminal
```

Step 2 Create policy profile for the WLAN.

Example:

```
Device(config)# wireless profile policy profile-name
```

The *profile-name* is the profile name of the policy profile.

Step 3 Configure air time fairness policy for 2.4- or 5-GHz radio.

Example:

```
Device(config-wireless-policy)# dot11 band airtime-fairness atf-policy-name
```

Example:

```
Device(config-wireless-policy)# dot11 24ghz airtime-fairness atf-policy-name
```

The *band* can be either 24ghz or 5ghz. The *atf-policy-name* is the name of the air time fairness policy.

Note
You can assign the same ATF policy to both 2.4-GHz and 5-GHz radios (or) have two different ATF policies as well.

Step 4 Return to privileged EXEC mode.

Example:

```
Device(config-wireless-policy)# end
```

Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

The Cisco ATF profile is now attached to the policy profile, enabling airtime fairness management for the specified radio band.

Enable ATF in the RF profile (GUI)

Procedure

Step 1 Choose **Configuration** > **Tags & Profiles** > **RF**.

Step 2 Click **Add**.
The **Add RF Profile** window is displayed.

Step 3 Click the **Advanced** tab.

Step 4 Under the **ATF Configuration** section, complete the following :

a) Use the slider to enable or disable the **Status**. The **Mode** field is displayed.

b) Click the **Monitor** mode or **Enforced** mode radio option. If you enable the **Enforced** mode, use the slider to enable or disable **Optimization**.

c) Use the slider to enable to disable **Bridge Client Access**. This is applicable for mesh mode APs. Bridge Client Access determines the percentage of the ATF policy weight that is allocated to clients connected to the mesh APs.

Step 5 Specify the **Airtime Allocation** value between 5 and 90.

Step 6 Click **Apply to Device**.

Enable ATF in the RF profile (CLI)

Enable Cisco ATF on 2.4 GHz or 5 GHz radios to manage air time allocation and improve network performance.

Cisco ATF must be enabled on 2.4 GHz or 5 GHz radios separately. Use this procedure when you need to configure air time fairness policies to ensure optimal wireless network performance and client experience.

Procedure

Step 1 Enter global configuration mode.

Example:

```
Device# configure terminal
```

Step 2 Configure an RF profile for 2.4- or 5-GHz radio.

Example:

```
Device(config)# ap dot11 frequency-band rf-profile rf-profile-name
```

Example:

```
Device(config)# ap dot11 24ghz rf-profile rfprof24_1
```

Where *frequency-band* is either 24ghz or 5ghz.

Step 3 Configure air time fairness mode.

Example:

```
Device(config-rf-profile)# airtime-fairness mode mode-type
```

Example:

```
Device(config-rf-profile)# airtime-fairness mode enforce-policy
```

Configures air time fairness in either of the modes:

- Enforce-policy—This mode signifies that the ATF is operational.
- Monitor—This mode gathers information about air time and reports air time usage.

Step 4 Enable the air time fairness optimization.

Example:

```
Device(config-rf-profile)# airtime-fairness optimization
```

Optimization is effective when the current WLAN reaches the air time limit and the other available WLANs does not use air time to its full extent.

Step 5 Return to privileged EXEC mode.

Example:

```
Device(config-rf-profile)# end
```

Alternatively, you can also press **Ctrl-Z** to exit global configuration mode.

ATF is now enabled in the RF profile and will manage air time allocation according to the configured policy mode.

Cisco ATF configuration verification

You can verify Cisco ATF configurations using these commands:

Table 1: Commands for verifying Cisco ATF configurations

Commands	Description
show wireless profile airtime-fairness summary	Displays the summary of air time fairness profiles.
show wireless profile airtime-fairness mapping	Displays the ATF policy mapping with the wireless profiles.
show ap airtime-fairness summary	Displays the ATF configuration summary of all radios.
show ap dot11 24ghz airtime-fairness	Displays the ATF configuration for 2.4-GHz radio.

Commands	Description
show ap dot11 5ghz airtime-fairness	Displays the ATF configuration for 5-GHz radio.
show ap name *ap-name* **airtime-fairness**	Displays the ATF configuration or statistics for an AP.
show ap name *ap-name* **dot11** {**24ghz** | **5ghz**} **airtime-fairness statistics summary**	Displays the ATF statistics of 2.4- or 5GHz radio.

Cisco ATF statistics verification

Use these commands to verify Cisco ATF statistics for WLANs, ATF policies, and individual clients.

Table 2: ATF statistics per WLAN

Commands	Description
show ap name *ap-name* **dot11** {**24ghz** | **5ghz**} **airtime-fairness wlan** *wlan_name* **statistics**	Displays the ATF statistics related to a WLAN.

Table 3: ATF statistics per ATF policy

Commands	Description
show ap name *ap-name* **dot11** {**24ghz** | **5ghz**} **airtime-fairness policy** *policy-name* **statistics**	Displays the ATF statistics related to an ATF policy.

Table 4: ATF statistics per client

Commands	Description
show ap airtime-fairness statistics client *mac_address*	Displays the ATF statistics related to a client.