Air Time Fairness in Mesh Deployments rel 8.4

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This section of the document introduces the ATF on Mesh APs and provides guidelines for its deployment. The purpose of this section is to:

- Provide an overview of ATF on Mesh APs
- Highlight supported Key Features
- Provide details on deploying and managing the ATF on Mesh APs

Pre-requisite and Supported Features in 8.4 release

Mesh ATF is supported on AireOS 8.4 or higher release on a Wireless LAN Controller . Mesh ATF is supported on 1550/128, 1570 and all other IOS based APs.

AP	1550 (64 MB)	1550 (128 MB)	1570	3700	1530	1540	1560
Feature	–	–	—	–	–	–	–
Basic Mesh	Yes	Yes	Yes	Yes	Yes	Yes	8.4
Flex+Mesh	Yes	Yes	Yes	Yes	Yes	No	No
Fast Convergence (background scanning)	No	8.3	8.3	Yes	8.3	No	8.4
Wired Clients on RAP	Yes	Yes	Yes	No	Yes	No	No

AP	1550 (64 MB)	1550 (128 MB)	1570	3700	1530	1540	1560
Wired Clients on MAP	Yes	Yes	Yes	No	Yes	No	8.4
Daisy Chain	7.6	7.6	7.6	No	7.6	No	No
LSC	Yes	Yes	Yes	Yes	Yes	No	No
PSK provisioning: MAP-RAP authentication	8.2	8.2	8.2	8.2	8.2	8.5	8.4
ATF on Mesh	No	8.4	8.4	8.4	No	No	No

Cisco Air Time Fairness (ATF) Use Cases

Public Hotspots (Stadium/Airport/Convention Center/Other)

In this instance 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 each group can be allocated a certain percentage of airtime.

Education

In this instance, a university is sharing a WLAN between students, faculty, and guests. The guest network can be further partitioned by service provider. Each group can be assigned a certain percentage of airtime.

Enterprise or Hospitality or Retail

In this instance, 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 airtime, for example a paid group is entitled to more airtime than the free group.

Time Shared Managed Hotspot

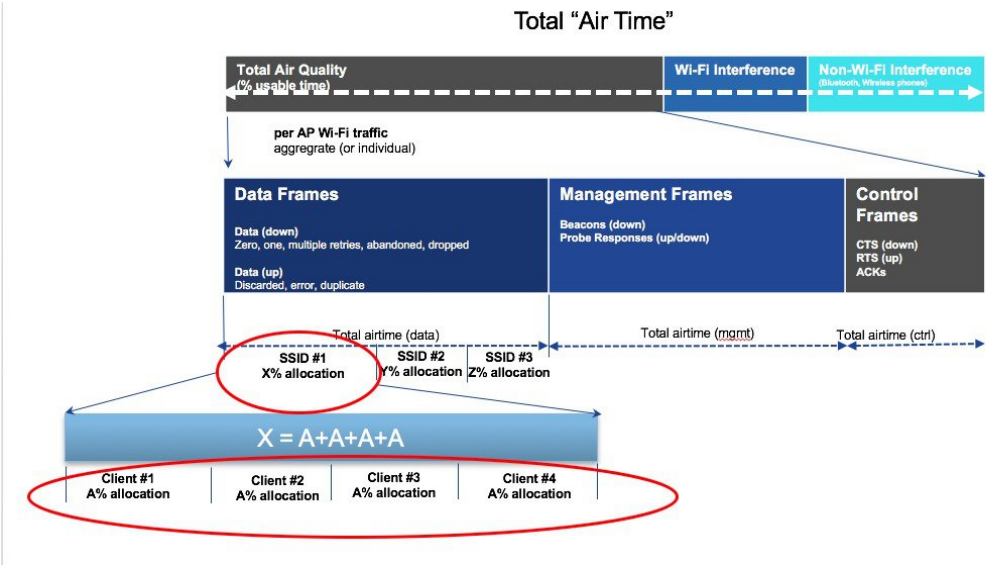
In this instance, the business entity managing the hotspot, such as a service provider or an enterprise, can allocate and subsequently lease airtime to other business entities.

ATF Functionality and Capabilities

ATF Functionality and Capabilities:

- ATF policies are applied only in the downlink direction (AP transmitting frames to client). Only airtime in the downlink direction, that is AP to client, can be controlled accurately by the AP. Although airtime in the uplink direction, that is client to AP, can be measured, it cannot be strictly controlled. Although the AP can constrain airtime for packets that it sends to clients, the AP can only measure airtime for packets that it 'hears' from clients because it cannot strictly limit their airtime

- ATF policies are applied only on wireless data frames; management and control frames gets ignored
- When ATF is configured per-SSID, each SSID is granted airtime according to the configured policy
- ATF can be configured to either drop or defer frames that exceed their airtime policies. If the frame is deferred, it will be buffered and transmit at some point in the future when the offending SSID has a sufficient airtime budget. Of course, there is a limit as to how many frames can be buffered. If this limit is crossed, frames will be dropped regardless
- ATF can be globally enabled or disabled
- ATF can be enabled or disabled on an individual access point, AP group or entire network
- Allocation is applied Per SSID and Per Client
- Applies to Downstream only
- Can be configured in WLC GUI/CLI and PI
- Can be applied to all APs on a Network to AP Group or one AP
- Supported on APs in Local mode: **AP1260, 1550-128Mb,1570, 1700, 2600, 2700, 3500, 3600, 3700**



ATF on Mesh Feature Overview

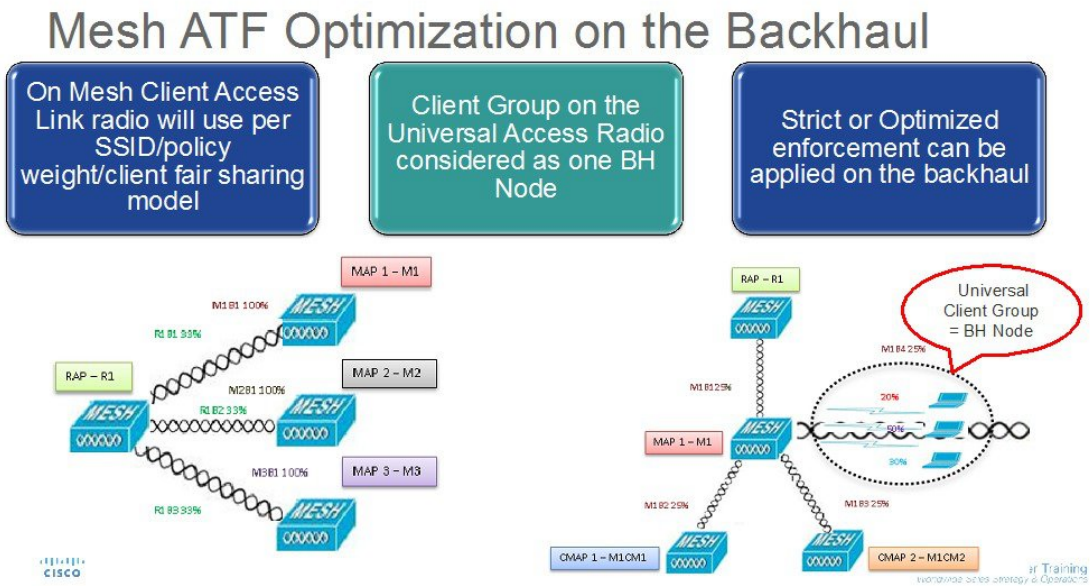
AirTime Fairness on Mesh Aps feature is very close conceptually to the ATF feature support release for Local Aps in theprevious releases. We are strongly recommend to review that feature and deployment steps in the guide at http://www.cisco.com/c/en/us/td/docs/wireless/technology/mesh/8-2/b_Air_Time_Fairness_Phase1_and_Phase2_Deployment_Guide.html

At the present time, enterprise class, high density stadium and other major Wi-Fi deployments with Cisco IOS 11n, 11ac Indoor APs are benefited by "per SSID" based Airtime Fairness and "per Client within a SSID" based Airtime Fairness through 8.1 MR1 and 8.2 releases.

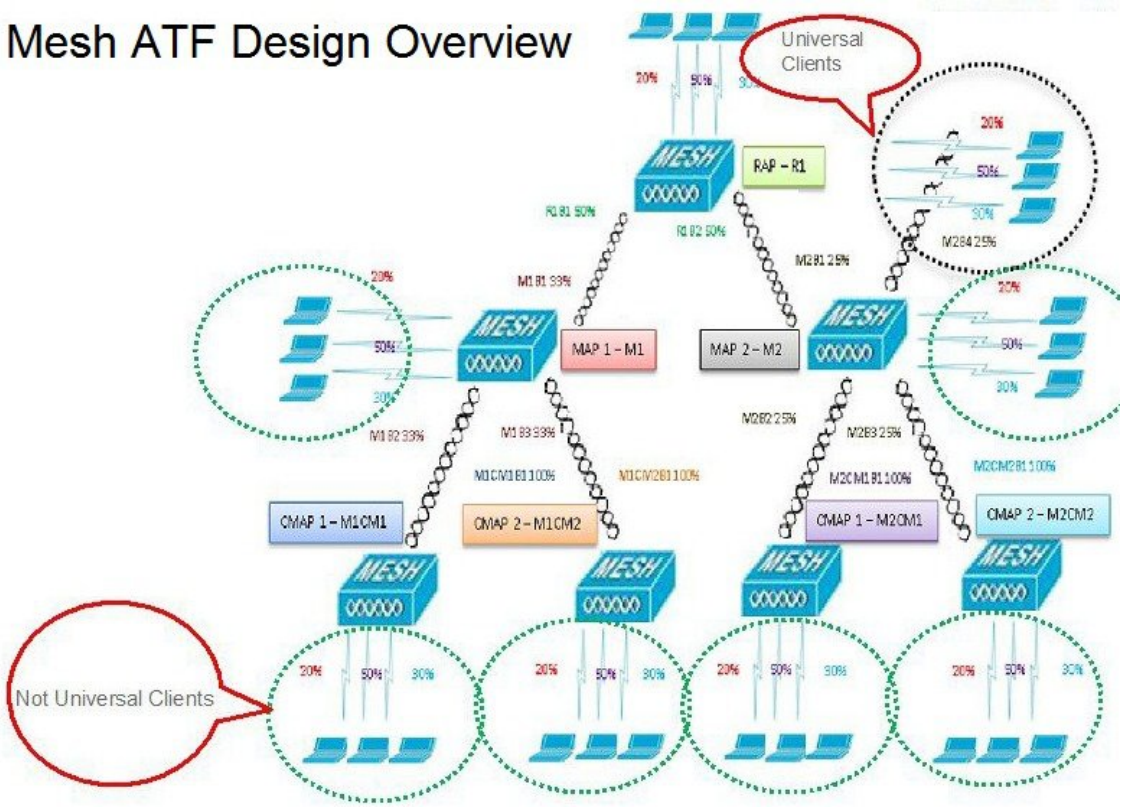
In a same way, currently, there is a demand from the Customers with large scale Outdoor wireless mesh deployments to serve their users by providing fairness among the Wi-Fi users across the Outdoor wireless mesh network in utilizing the AP radio Airtime downstream and also provide administrators the key control to enforce SLA (implied on multiple cellular operator through Wi-Fi hotspot) on the Wi-Fi users across the Outdoor wireless mesh network. However, since all Wi-Fi users traffic is bridged between MAPs and RAPs through the wireless backhaul radio and there is no SSID concept on wireless backhaul radio for backhaul nodes to enforce policies through SSID's for each backhaul node, there is no easy solution for Wi-Fi users across the Outdoor wireless mesh network to get treated fairly in terms of utilizing the Wi-Fi airtime through their Outdoor Wireless Mesh Aps. As far as the clients on client access radios are concerned, it's fairly simple to regulate the airtime fairness through SSIDs (w/ or w/o client fair sharing) in a similar way how it is done for Cisco unified local mode APs.

Before the solution overview of supporting ATF on mesh, lets quickly recap ATF - Airtime Fairness (ATF) is basically a concept which provides an ability to regulate/enforce the AP radio airtime in downstream direction for the clients associated through the SSID's. As a result, the Wi-Fi users on wireless network are fairly treated in terms of utilizing the radio WiFi radio airtime. This basically provides the key control either to enforce SLA additionally or simply to avoid certain group or individual from occupying an unfair amount of WiFi airtime on a particular or on a given AP radio. A service level agreement (SLA) is a contract between a service provider (either internal or external) and the end user that defines the level of service expected from the service provider. SLAs are output-based in that their purpose is specifically to define what the customer will receive.

In general, in the Mesh architecture, the Mesh Aps (Parents, child MAPs) in a Mesh Tree will be accessing the same channel (let's forget about extended sub-backhaul radios for a minute) on backhaul radio for mesh connectivity between Parents and child Maps. Whereas, the Root AP will be connected wired to the controller and MAPs will be connected wireless to the controller. Hence all the CAPWAP, Wi-Fi traffic will be bridged to the controller through the wireless backhaul radio and through RAP. In terms of the physical locations, normally the RAPs will be placed at roof top and the MAPs in multiple hops will be placed some distance apart within each other based on the Mesh network segmentation guidelines. Hence each MAP in a Mesh tree can provide 100% of their own radio airtime downstream to their users though each MAP accessing the same medium. To compare this in non-mesh scenario, where there can be neighboring local mode unified Aps in the arena next to each other in different rooms serving to their respective clients on the same channel with each providing 100% radio airtime downstream. Therefore, ATF has no control over enforcing clients in two different neighboring AP's accessing the same medium. Similarly, it's applicable for MAPs in a Mesh tree. For Outdoor/Indoor Mesh Aps, Airtime fairness must be supported on client access radios which serve regular clients as same as how we currently support ATF on non-mesh unified local mode Aps to serve the clients and additionally it must also be supported on backhaul radios which bridge the traffic to/from the clients on client access radios to RAPs (one hop) or through MAPs to RAPs (multiple hops). Its bit tricky to support ATF on backhaul radio's using the same SSID/Policy/Weight/Client fair sharing model. Since backhaul radio's doesn't have SSIDs and it always bridges traffic through their hidden backhaul nodes. Henceforth, on the backhaul radios either in RAP or MAP, the radio airtime downstream will be fair shared equally based on the number of backhaul nodes. This approach eliminates the problem and provides fairness to users across wireless mesh network in the case where the clients associated to 2^{nd} hop MAP can stall the clients associated to 1^{st} hop MAP where 2^{nd} hop MAP is connected wireless to 1^{st} hop MAP through backhaul radio though the Wi-Fi users in the MAPs are separated by a physical location. In the scenario, when a backhaul radio has an option to serve normal clients through universal client access feature, ATF considers the regular clients into single node and group them into it. It enforces the Airtime by equally fair sharing the radio airtime downstream based on the number of nodes (backhaul nodes + single node for regular clients). We will see more details how this solution is turned into design in the next sections.



A bigger mesh design will looks like this:



ATF Modes of Operation

The Framework behind the ATF monitor mode is to allow the user to view and get the stats of overall Air Time being used i.e. to report the Air Time usage for all the AP transmissions. The ATF in monitor mode can be enabled on following levels.

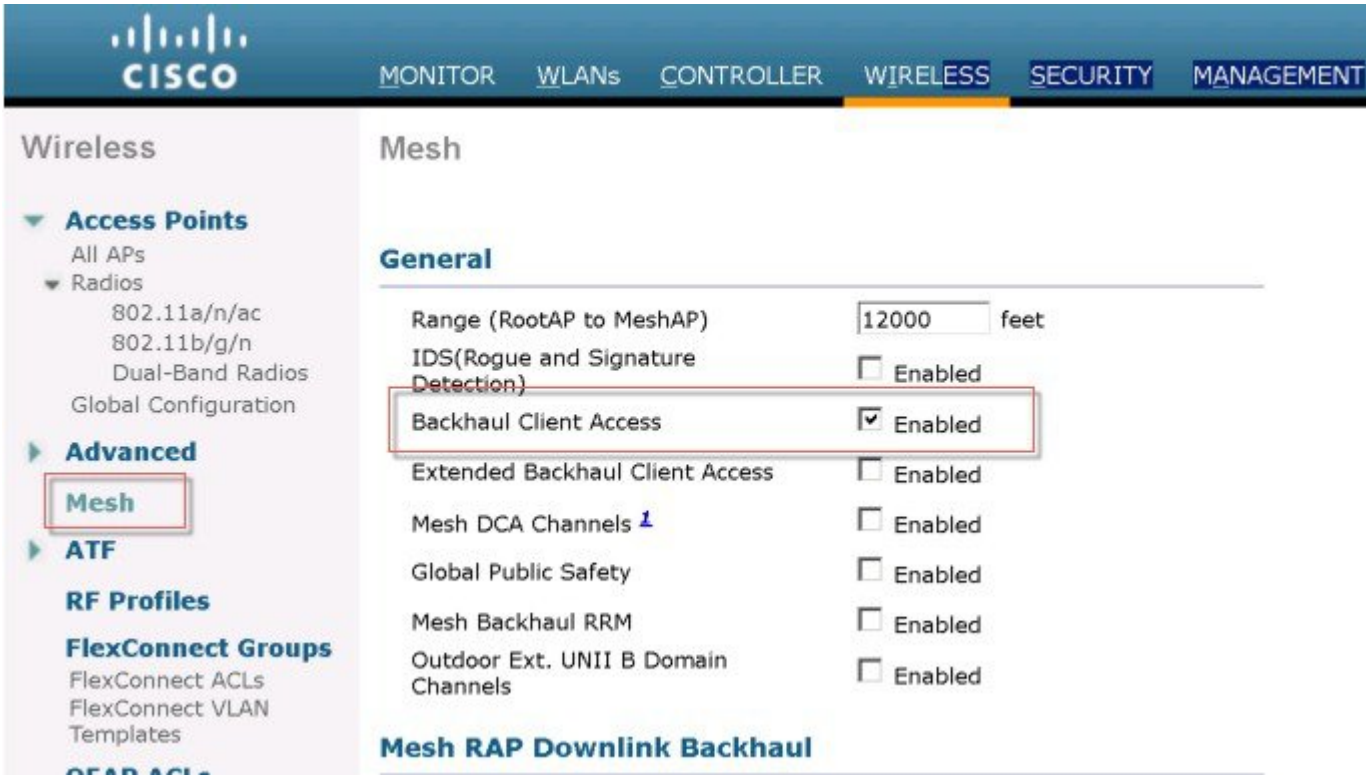
- Disable Mode: By default ATF is disabled on the WLC
- Monitor Mode: To monitor airtime usage on your network
- Enforce—Policy Mode: Assigning ATF policies on your network
- Strict Enforcement
- Optimized

Configuring ATF on Mesh

To configure, ATF on mesh, perform the following steps:

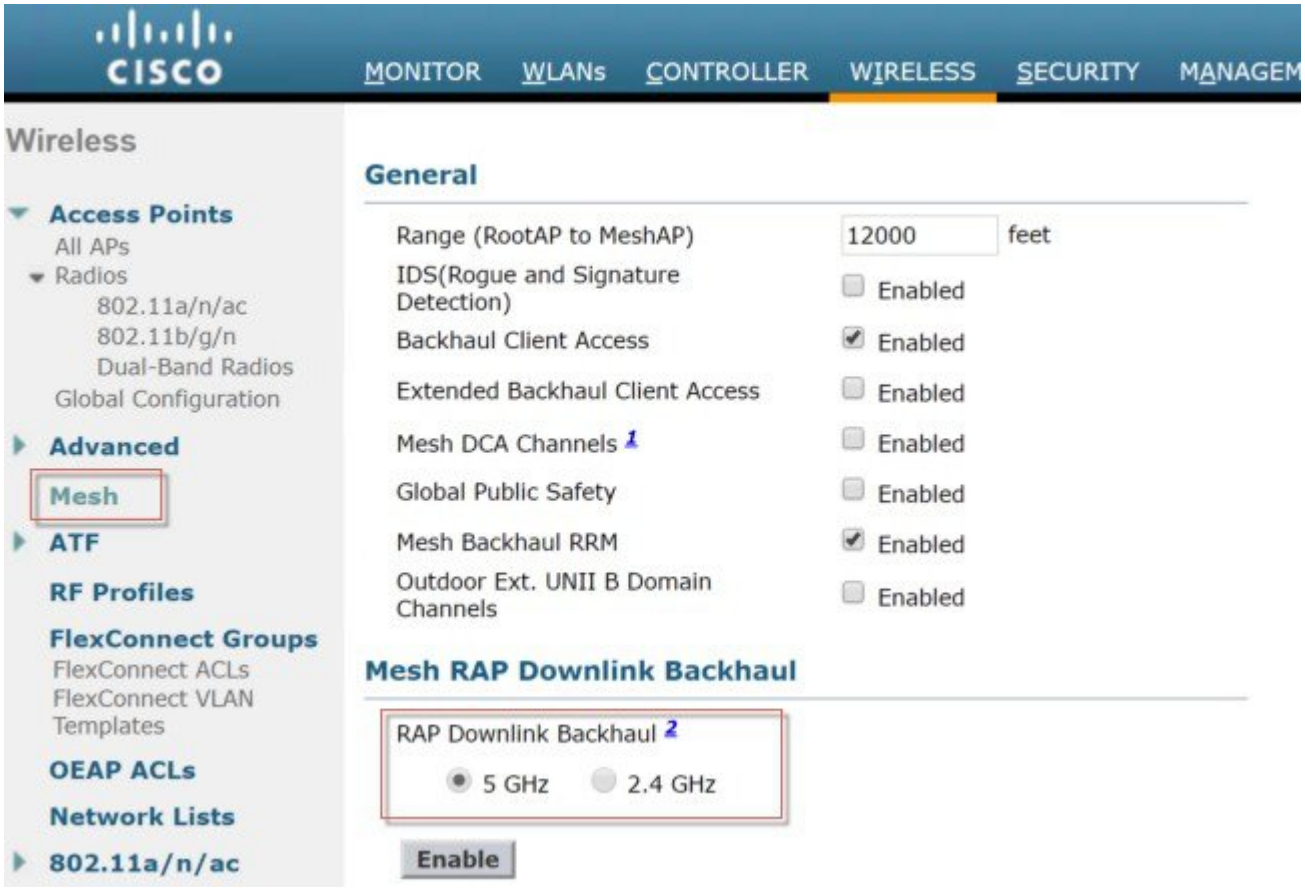
Step 1 Backhaul Client Access- enable/disable.

```
(5520-MA1) >config mesh client-access enable
```



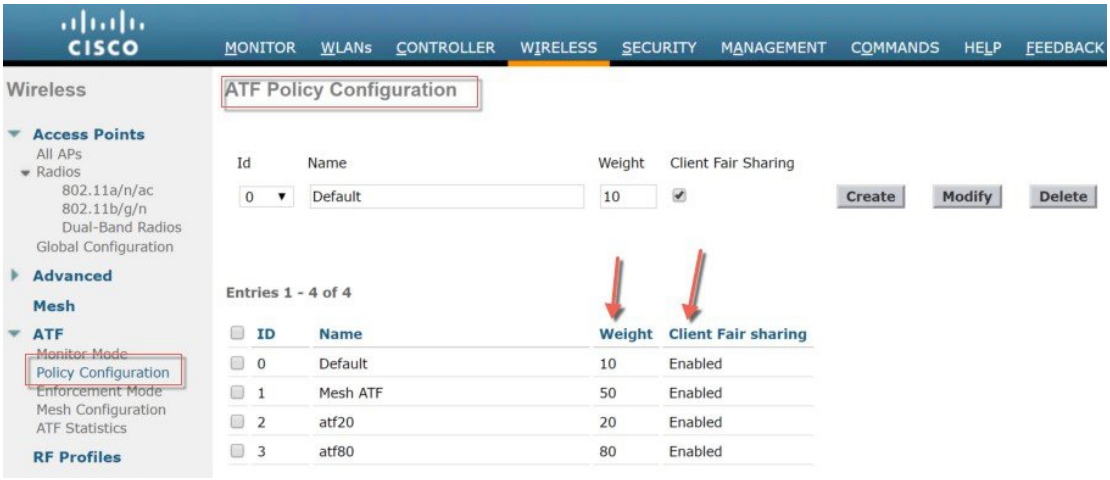
Step 2 RAP Downlink Backhaul configure 5 or 2.4 GHz

```
(5520-MA1) >config mesh backhaul slot <0/1> all
```



Step 3 Create ATF Policy with Weight and Client Sharing

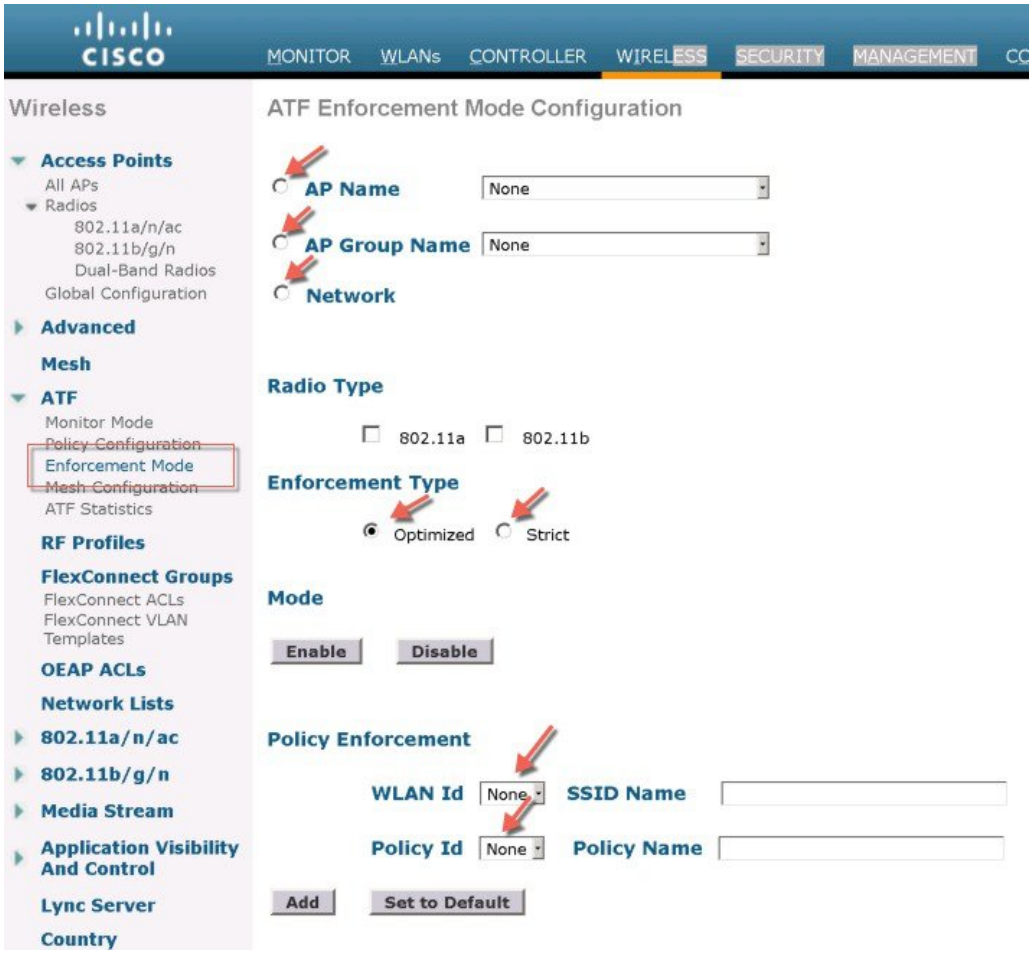
```
(5520-MA1) >config atf 802.11a mode ?

disable         Disables ATF
enforce-policy Configures ATF in enforcement mode
monitor         Configures ATF in monitor mode

(5520-MA1) >config atf 802.11a mode enforce-policy


(5520-MA1) >config atf policy create 1 mesh 25 client-sharing enable
```



Step 4 Configure Enforcement mode per AP/AP Group/Network with Enforcement type and WLAN and Policy applied.

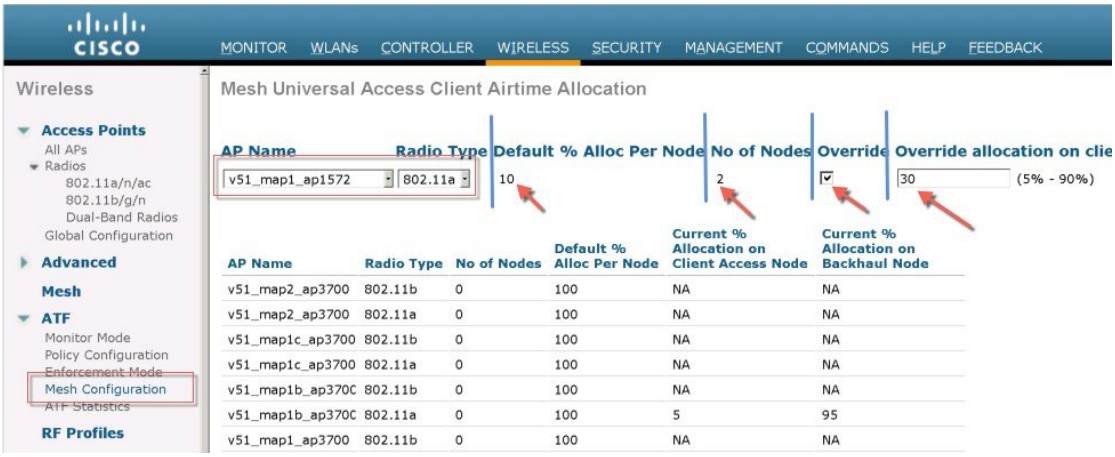
Figure 1:

```
(5520-MA1) >config atf 802.11a optimization enable
```



Step 5 Configure Mesh Universal Access Client Airtime Allocation.

```
> config ap atf 802.11a client-access airtime-allocation <5 - 90> <ap-name> override enable
/disable
> config ap atf 802.11b client-access airtime-allocation <5 - 90> <ap-name> override enable/disable
```


MONITOR WLANs CONTROLLER WIRELESS SECURITY MANAGEMENT COMMANDS HELP FEEDBACK
Wireless
Access Points
All APs
Radios
802.11a/n/ac
802.11b/g/n
Dual-Band Radios
Global Configuration
Advanced
Mesh
ATF
Monitor Mode
Policy Configuration
Enforcement Mode
Mesh Configuration
ATF Statistics
RF Profiles
Mesh Universal Access Client Airtime Allocation
AP Name
Radio Type
Default % Alloc Per Node
No of Nodes
Override
Override allocation on clie
v51_map1_ap1572
802.11a
10
2
30
(5% - 90%)
AP Name
Radio Type
No of Nodes
Default % Alloc Per Node
Current % Allocation on Client Access Node
Current % Allocation on Backhaul Node
v51_map2_ap3700 802.11b 0 100 NA NA
v51_map2_ap3700 802.11a 0 100 NA NA
v51_map1c_ap3700 802.11b 0 100 NA NA
v51_map1c_ap3700 802.11a 0 100 NA NA
v51_map1b_ap370C 802.11b 0 100 NA NA
v51_map1b_ap370C 802.11a 0 100 5 95
v51_map1_ap3700 802.11b 0 100 NA NA