RF based Automatic AP Load Balancing

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RF based automatic AP load balancing is a wireless network load management feature that

- groups APs dynamically using RRM neighbor report-based AP grouping
- balances AP clusters across WNCd instances to optimize resource usage, and
- overrides site tag-based load balancing to ensure even AP distribution and prevent overload.

The RF based Automatic AP Load Balancing feature builds on the existing site tag-based load balancing feature. In the existing method, APs are balanced by assigning them to wireless network control daemons (WNCd) based on site tags. If the number of APs in a named site tag exceeds the capacity of a WNCd instance, uneven AP distribution may occur, which can result in high memory and CPU usage.

Limiting the number of APs in a site tag to 1000 using the **load** command may not prevent uneven distribution if the AP load limit is not correctly configured. In some cases, APs assigned to a site tag may not be colocated.

When you enable this feature, it forms AP clusters based on RSSI values from AP neighbor reports. The clusters are divided into sub-neighborhoods and smaller areas, which are then distributed evenly across WNCd processes. AP load balancing becomes active after you reboot the controller or perform an AP CAPWAP reset using the **ap neighborhood load-balance apply** command. When active, RF based Automatic AP Load Balancing overrides site tag-based load balancing.

Supported platforms

- Cisco Catalyst 9800-80 Wireless Controller
- Cisco Catalyst 9800-40 Wireless Controller
- Cisco Catalyst 9800 Wireless Controller for Cloud
- Catalyst 9800 Embedded Wireless Controller for a Cisco switch

Prerequisites for RF based automatic AP load balancing

Before enabling RF-based automatic AP load balancing, make sure your network is stable and all APs are fully deployed with enough time to discover all RF neighbors.

Use cases for RF based automatic AP load balancing

- You can use a single site tag for all deployed APs.
- If you attach more APs to a named-site tag than the available capacity of the WNCds, this feature provides better load balancing across WNCd instances.
- Use this feature in environments with many client intra-WNCd roaming scenarios. For instance, if you manage APs in two separate buildings on a campus, assign all APs for each building to a single WNCd rather than splitting them across multiple WNCds.

Feature history

This table provides release and related information about the feature explained in this section.

This feature is also available in all the releases subsequent to the one in which they are introduced in, unless noted otherwise.

Table 1: Feature history for RF based automatic AP load balancing

Feature Name	Release Information	Feature Description
RF based automatic AP load balancing	Cisco IOS XE 17.12.1	The RF based Automatic AP Load Balancing feature uses Radio Resource Management (RRM) neighbor report-based AP grouping and load-balancing across WNCd instances. These commands are introduced: • apneighborhood load-balance • apneighborhood calendar-profile • wirelessload-balance ap method rf • showap neighborhood summary • showap neighborhood details • showap neighborhood • showap neighborhood mac details • showap neighborhood wncd

Restrictions and guidelines for RF based automatic AP load balancing

Restrictions for RF based automatic AP load balancing

- You cannot use the same calendar profile for AP neighborhood policy or AP profile.
- This feature is supported only on APs in local, fabric, and FlexConnect mode.
- You cannot run the feature when the overall load on the system is high.
- You cannot use the output of the **show wireless loadbalance tag affinity** command when the RF based automatic AP load balancing feature is enabled.

Guidelines for RF based Automatic AP Load Balancing

- For a new deployment, use the site tags and follow the current site tag recommendations to evenly distribute the APs, or use the **site tag load** command to automatically distribute the APs. Using site tags ensures that all APs with the same site tag are assigned to the same WNCd. This arrangement simplifies both troubleshooting and intra-WNCd roaming.
- If you cannot use site tags because grouping APs is not possible or you wish to avoid additional design work, select either the default site tag or any named site tag and enable the RF-based automatic AP load balancing feature.
- In an existing deployment, if high CPU usage results from an unbalanced system, use the auto RRM load balance system instead of redesigning site tags.
- If no CPU load issues exist, even though the system is unbalanced, maintain your current configuration.

Configure RF based automatic AP load balancing

Achieve balanced AP distribution across wireless controllers using RF metrics through commands.

Before you begin

The enablement of the RF-based load-balancing algorithm involves two phases.

1. In the first phase, the running of the algorithm, the RF-based automatic AP load balancing feature can be scheduled to run when the calendar profile start time expires using the **ap neighborhood calendar-profile** command, or it can be started on-demand using the **ap neighborhood load-balance start** command. You can schedule the calendar profile start timer to run daily, weekly, or monthly.

Note For more information on configuring Calendar profile, check Configure a calendar profile (GUI) and Configure a calendar profile (CLI).

2. To apply the algorithm, reload the controller or use the **ap neighborhood load-balance apply** command after the wireless load-balance ap method rf configuration is enabled.

Procedure

Step 1 Enter the global configuration mode.

Example:

```
Device# configure terminal
```

Step 2 Configure an AP neighborhood calendar profile.

Example:

```
Device(config)# ap neighborhood calendar-profile ap-calendar-profile
```

Note
After setting the calendar profile, you can choose to skip Step 4. If you want to perform load balancing immediately, complete Step 4.

Step 3 Return to the privileged EXEC mode.

Example:

```
Device(config)# exit
```

Step 4 (Optional) Start AP neighborhood load-balance algorithm calculation and WNCd allocation.

Example:

```
Device# ap neighborhood load-balance start
```

Step 5 Enter the global configuration mode.

Example:

```
Device# configure terminal
```

Step 6 Configure RF-based AP load balancing.

Example:

```
Device(config)# wireless load-balance ap method rf
```

Step 7 Return to the privileged EXEC mode.

Example:

```
Device(config)# exit
```

Step 8 Run on-demand RRM-based AP load balancing.

Example:

```
Device# ap neighborhood load-balance apply
```

This command rebalances the APs by performing a CAPWAP reset. If an AP is already assigned to the correct WNCd instance, it is not reset. You cannot execute this command if the RRM-based AP load balancing algorithm is running or if algorithm results are unavailable.

Disable RF based automatic AP load balancing (CLI)

Disable the RF-based automatic AP load balancing feature to prevent APs from using RF data to evenly distribute clients and APs using commands.

Before you begin

The APs may remain load balanced based on algorithm data, even after you disable all feature configurations and clear all algorithm outputs. To rebalance all APs using the default method of site tags, reload the controller or perform a CAPWAP reset on all APs.

Procedure

Step 1 Enter the global configuration mode.

Example:

```
Device# configure terminal
```

Step 2 Disable RF-based AP load balancing.

Example:

```
Device(config)# no wireless load-balance ap method rf
```

Step 3 Disable the AP neighborhood calendar profile.

Example:

```
Device(config)# no ap neighborhood calendar-profile ap-calendar-profile
```

Step 4 Return to the privileged EXEC mode.

Example:

```
Device(config)# exit
```

Step 5 Clear the AP neighborhood load-balance algorithm calculation and resource allocation.

Example:

```
Device# ap neighborhood load-balance clear
```

Verify automatic WNCd load balancing

To verify the results of the RF-based algorithm and the result of the related load balancing, use these**show** commands.

To view the AP neighborhood summary, use this **show** command:

```
Device# show ap neighborhood summary
NH-ID = Neighborhood ID
AREA-ID = Area ID of neighborhood
Total number of neighborhood: 5
Total number of algorithm iterations: 1
```

```
Ideal AP capacity per WNCD instance: 210
Total number of neighborhood area: 14
NH-ID      AREA-ID         Process Name   Number of APs
-------------------------------------------------
0          0x00000000      WNCD_1         1
1          0x00000000      WNCD_0         2
2          0x00000000      WNCD_0         100
2          0x00000001      WNCD_0         100
2          0x00000002      WNCD_3         100
2          0x00000003      WNCD_4         50
3          0x00000000      WNCD_1         100
3          0x00000001      WNCD_1         100
3          0x00000002      WNCD_4         100
3          0x00000003      WNCD_4         50
4          0x00000000      WNCD_2         100
4          0x00000001      WNCD_2         100
4          0x00000002      WNCD_3         100
4          0x00000003      WNCD_3         50
```

To view the AP neighborhood details, use this **show** command:

```
Device# show ap neighborhood details
NH-ID = Neighborhood ID
AREA-ID = Area ID of neighborhood
Number of APs: 4
NH-ID   AREA-ID        WNCD instance    AP Name                 Ethernet MAC
-------------------------------------------------------------------------------
0       0x00000000     1                EDU_BR_01_00_28_3702    bc16.6509.bfcc
1       0x00000000     0                ci-glad-mdns-ap         0cd0.f894.567c
1       0x00000000     0                EDU_VW_9120_1_2         c4f7.d54c.f978
2       0x00000000     0                ewlc-hc-tsim-30-1       00b9.3000.02f0
```

To view the AP neighborhood information, use this **show** command:

```
Device# show ap neighborhood 0 details
NH-ID = Neighborhood ID
AREA-ID = Area ID of neighborhood
Number of APs: 1
NH-ID     AREA-ID          WNCD instance     AP Name               Ethernet MAC
-------------------------------------------------------------------------------
0         0x00000000       0                 APA023.9FD8.EA22      a023.9fd8.ea22
```

To view the AP neighborhood details using its MAC address, use this **show** command:

```
Device# show ap neighborhood mac 0aa8.89f0.0001 details
NH-ID = Neighborhood ID
AREA-ID = Area ID of neighborhood
AP Name            Ethernet MAC    Radio MAC       NH-ID  AREA-ID     WNCD instance
-------------------------------------------------------------------------------------
AP6B8B4567-0001    0aa8.89f0.0001  0aa8.8900.0100  0      0x00000000  0
```

To view the WNCd information, use this **show** command:

```
Device# show ap neighborhood wncd 0 details
NH-ID = Neighborhood ID
AREA-ID = Area ID of neighborhood
Number of APs: 9
WNCD instance     NH-ID       AREA-ID          AP Name          Ethernet MAC
-------------------------------------------------------------------------------------------------
0                 2           0x00000000       9130I-1          0c75.bdb5.ffc0
0                 2           0x00000000       9130E-2          3c41.0efe.46f0
0                 2           0x00000000       9120E-2          5ce1.7628.8bbc
0                 2           0x00000000       9130I-2          e44e.2d2e.59d4
0                 2           0x00000000       9120E-1          5ce1.7628.aa0c
0                 2           0x00000000       9120E-3          5ce1.7628.af04
0                 2           0x00000000       3700I-2          b838.6159.dfa4
```

```
1                0           0x00000000       3800I-2          6cb2.ae2e.dfdc
2                1           0x00000000       4800-1           f4db.e643.fa72
NH-ID = Neighborhood ID
AREA-ID = Area ID of neighborhood
Number of APs: 5
WNCD instance    NH-ID   AREA-ID       AP Name             Ethernet MAC
-----------------------------------------------------------------------
0                12      0x00000000    AP6B8B4567-0001     0aa8.89f0.0001
0                12      0x00000000    AP6B8B4567-0004     0aa8.89f0.0004
0                12      0x00000000    AP6B8B4567-0007     0aa8.89f0.0007
0                12      0x00000000    AP6B8B4567-0010     0aa8.89f0.000a
0                12      0x00000000    AP6B8B4567-0013     0aa8.89f0.000d
```