



## Target Wake Time

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## Target Wake Time

The existing Wi-Fi client power-saving mechanisms have been in use since 802.11b, where the client devices sleep between AP beacons or multiple beacons, waking up only when they have data to transmit (they can transmit at any time, as AP does not sleep), and beacons containing the Delivery Traffic Indication Map (DTIM), a bit-map, indicates that the AP has downlink traffic buffered for transmission to particular clients.

If a client has a DTIM bit set, it can retrieve data from the AP by sending a Power-Save Poll (PS-Poll) frame to the AP. This power-save scheme is effective but only allows clients to doze for a small beacon interval. Clients still need to wake up several times per second to read DTIM from the beacon frame of the AP.

With 802.11e, the new power-saving mechanism was introduced that helps voice-capable Wi-Fi devices, as voice packets are transmitted at short time intervals, typically 20 ms/sec. Unscheduled automatic power-save delivery (U-APSD) allows a power-save client to sleep at intervals within a beacon period. AP buffers the downlink traffic until the client wakes up and requests its delivery.

## Extended Power-Savings Using Target Wake Time

Target wake time (TWT) allows an AP to manage activity in the Wi-Fi network, in order to minimize medium contention between Stations (STAs), and to reduce the required amount of time that an STA in the power-save mode needs to be awake. This is achieved by allocating STAs to operate at non-overlapping times, and/or frequencies, and concentrate the frame exchanges in predefined service periods.

TWT capable STA can either negotiate an individual TWT agreement with TWT-scheduling AP, or it can elect to be part or member of Broadcast TWT agreement existing on the AP. An STA does not need to be aware that a TWT service period (SP) can be used to exchange frames with other STAs. Frames transmitted during a TWT SP can be carried in any PPDU format supported by the pair of STAs that have established the TWT agreement corresponding to that TWT SP, including High Efficiency Multi-User Physical Protocol Data Unit (HE MU PPDU), High Efficiency Trigger-Based Physical Protocol Data Unit (HE TB PPDU), and so on.

Following are the TWT Agreement Types:

### Individual TWT

Single TWT session is negotiated between AP and an STA. This ensures a specific service period of DL and UL between AP and STA with expected traffic to be limited within the negotiated SP of 99% accuracy. The service period starts at specific offset from the target beacon transmission time (TBTT) and runs for the SP duration and repeats every SP interval.

TWT Requesting STA communicates the Wake Scheduling information to its TWT responding AP, which then devises a schedule and delivers the TWT values to the TWT requesting STA when a TWT agreement has been established between them.

### Solicited TWT

STA initiates the TWT session with the AP.

### Unsolicited TWT

AP initiates TWT setup with STA. AP sends TWT response with service period which is accepted by STA.

### Broadcast TWT

High-Efficiency AP requests the STA to participate in the broadcast TWT operation, either on-going broadcast SP or new SP.

## Configuring Target Wake Time at the Radio Level (CLI)

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>ap dot11 {24ghz   5ghz } shutdown</b> <b>Example:</b> Device(config)#ap dot11 24ghz shutdown	Disables the 802.11a or 802.11b network.
<b>Step 3</b>	<b>ap dot11 {24ghz   5ghz } dot11ax</b> <b>Example:</b> Device(conf)#ap dot11 24ghz dot11ax	Configures the 802.11ax parameters.
<b>Step 4</b>	<b>[no] ap dot11 {24ghz   5ghz } dot11ax target-wakeup-time</b> <b>Example:</b> Device(config)#ap dot11 24ghz dot11ax target-wakeup-time	Configures the 802.11ax target wake-up time.
<b>Step 5</b>	<b>[no] ap dot11 {24ghz   5ghz } dot11ax target-waste-time</b>	Configures the 802.11ax target waste-time.

	Command or Action	Purpose
	<b>Example:</b> Device(config)#ap dot11 24ghz dot11ax target waste-time	
<b>Step 6</b>	<b>no ap dot11 { 24ghz   5ghz } shutdown</b> <b>Example:</b> Device(config)#no ap dot11 24ghz shutdown	Enables the 802.11a or 802.11b network.
<b>Step 7</b>	<b>show ap dot11 { 24ghz   5ghz } network</b> <b>Example:</b> Device(config)#show ap dot11 24ghz network	Displays the 802.11ax network configuration details, which includes information about Target Wakeup Time and Target Wakeup Broadcast.

## Configuring Target Wake Time on WLAN

### Enabling Target Wake Time on WLAN (CLI)

#### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>wlan wlan-profile</b> <b>Example:</b> Device(config)# wlan wlan-profile	Enters WLAN configuration submode. The <i>wlan-profile</i> is the profile name of the configured WLAN.
<b>Step 3</b>	<b>shutdown</b> <b>Example:</b> Device(conf-wlan)#shutdown	Disables the WLAN network
<b>Step 4</b>	<b>dot11ax target-waketime</b> <b>Example:</b> Device(conf-wlan)#dot11ax target-waketime	Configures target wake time mode on WLAN.
<b>Step 5</b>	<b>dot11ax twt-broadcast-support</b> <b>Example:</b> Device(conf-wlan)#dot11ax twt-broadcast-support	Configures the TWT broadcast support on WLAN.

	Command or Action	Purpose
<b>Step 6</b>	<b>no shutdown</b> <b>Example:</b> Device(conf-wlan)#no shutdown	Enables WLAN.
<b>Step 7</b>	<b>show wlan {all   id   name   summary}</b> <b>Example:</b> Device# show wlan all Device# show wlan id Device# show wlan name	Displays the details of the configured WLAN, including Target Wakeup Time and Target Wakeup Time Broadcast.

## Disabling Target Wakeup Time on WLAN (CLI)

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>wlan <i>profile-name</i></b> <b>Example:</b> Device(config)# wlan <i>wlan-profile</i>	Enters WLAN configuration submode. The <i>wlan-profile</i> is the profile name of the configured WLAN.
<b>Step 3</b>	<b>shutdown</b> <b>Example:</b> Device(conf-wlan)#shutdown	Disables the WLAN network
<b>Step 4</b>	<b>no dot11ax target-waketime</b> <b>Example:</b> Device(conf-wlan)#no dot11ax target-waketime	Disables the target wake time mode on WLAN.
<b>Step 5</b>	<b>no dot11ax twt-broadcast-support</b> <b>Example:</b> Device(conf-wlan)#no dot11ax twt-broadcast-support	Disables the TWT broadcast support on WLAN.
<b>Step 6</b>	<b>no shutdown</b> <b>Example:</b> Device(conf-wlan)#no shutdown	Enables WLAN.

# Configuring Target Wake Time (GUI)

## Procedure

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- Step 1** Choose **Configuration > Radio Configurations > Parameters**.
- The parameters page is displayed where you can configure global parameters for 5 GHz Band and 2.4 GHz Band radios.
- Step 2** In the **11ax Parameters** section, check the **Target Wakeup Time** check box and the **Target Wakeup Time Broadcast** check box to configure target wakeup time and broadcast target wakeup time.
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## Verifying Target Wakeup Time

To verify Target Wakeup Time and Target Wakeup Time Broadcast, use the following command:

**show ap dot11 24ghz network**

The following is a sample output:

```
Device#show ap dot11 24ghz network
.
.
.
802.11ax                : Enabled
Target Wakeup Time     : Enabled
Target Wakeup Time Broadcast : Enabled
.
.
.
```

