

Improving client Handover and roaming between APs

There are a few standards and methodologies available to use to improve handover of clients between APs. Most are focussed on VOIP technologies, but it must always be remembered that we cannot control the client Handover (especially with legacy clients) we can only encourage them. Some Standards and methods work well for some environments and some do not - test the recommendations extensively before implementing in a live Production environment. It must also be noted that all settings take effect immediately once applied, however from a client perspective it might need to re-associate for the changes to take effect client side. As with everything else in IT, if a perfect method/solution existed there would only be one - try them all and keep the best.

The Standards and Definitions

802.11k

IEEE 802.11k allows a device to quickly identify nearby APs that are available for roaming. When the signal strength of the current AP weakens and the device needs to roam to a new AP, it will already know the best candidate AP with which to connect to.

802.11r

IEEE 802.11r specifies fast Basic Service Set (BSS) transitions between access points by redefining the security key negotiation protocol, allowing both the negotiation and requests for wireless resources to occur in parallel. When a device roams from one AP to another on the same network, 802.11r streamlines the authentication process. BSS allows a devices to associate with APs more quickly. Coupled with 802.11k's ability to quickly identify the target AP, BSS's faster association method may enhance application performance.

Handoff Assist

The AP monitors the RSSI for every associated client. If the RSSI for a specific client falls below "low-rssi-threshold" and continues to fall for the "rssi-falloff-wait-time", then the AP will send a de-auth to the client. The de-auth is meant to kick the client away from the current AP and get it to re-authenticate to a nearby AP. This will have the effect of helping a client handover between 2 APs. BUT (Big But), if the client gets de-authed and takes a while to re-authenticate (if it even does re-authenticate automatically after a de-auth), then this will have the effect of destroying communication instead of helping it -- mostly found with legacy clients.

Remove Lower Transmit Rates

Removing lower transmit rates is a way to promote better roaming, BUT not all clients respond well, or even respond to it.

The practice is that the basic rates are a subset of the transmit rates. If you only want to allow speeds 9 and up, you would select only the transmit rates of 9 and up, and the basic rates of 9 and 11. If a legacy client expects the rates of 1 and 2 it will not connect.

Local Probe Threshold

Local probe Threshold prevents a client from connecting to an AP with a too low a signal - helps more with initial connection than roaming.

The local probe threshold parameter is not supposed to force clients to roam as soon as they pass near an access point with a good signal, but rather to NOT hold on to an access point with a weak signal (avoiding sticky clients).

PMK Caching

Defined by 802.11i and is a technique available for authentication between a single AP and a station. If a station has authenticated to an AP, roams away from that AP, and comes back, it does not need to perform a full authentication exchange. Only the 802.11i 4-way handshake is performed to establish transient encryption keys.

Opportunistic Key Caching (OKC)

Is a similar technique to PMK, but not defined by 802.11i, for authentication between multiple APs in a network where those APs are under common administrative control. An Aruba deployment with multiple APs under the control of a single controller is one such example. Using OKC, a station roaming to any AP in the network will not

have to complete a full authentication exchange, but will instead just perform the 4-way handshake to establish transient encryption keys

Implementation and Configuration

802.11k

802.11k is configured in your VAP profile. Tick the option to “Advertise 802.11k”. There after set the Handover Trigger Feature Settings.

Wireless LAN

Virtual AP

net-wireless

802.11k

802.11k Advert

802.11K Profile > 802.11k Advert

Advertise 802.11K Capability ☒

Forcefully disassociate on-hook voice clients ☐

Measurement Mode for Beacon Reports beacon-table

Tick the “Enable Handover Trigger feature” and then set RSSI threshold by specifying the -dBm level at what the hand over trigger should be sent to the client

Virtual AP

net-wireless

802.11k

Handover Trigger Feature Settings

Handover Trigger Feature Settings > HOT 65

Enable Handover Trigger feature ☒

Threshold signal strength value at which Handover Trigger should be sent to the client 65 -dBm

802.11r

802.11r is configured under SSID of your VAP profile. Tick the option to “Advertise 802.11r”

Virtual AP

net-wireless

SSID

802.11r

802.11r Advert

802.11r Profile > 802.11r Advert

Advertise 802.11r Capability ☒

802.11r Mobility Domain ID 1

802.11r R1 Key Duration 3600

Handoff Assist

Station Handoff Assist is enabled in RF Optimization under the RF Management section of AP configuration.

Tick the “Station Handoff Assist” option to enable it, next set the Low RSSI Threshold – the threshold determines above what level no deauth gets sent

Wireless LAN

RF Management

802.11g radio

RF Optimization

RF Optimization profile > HandOff Assist

Station Handoff Assist ☒

RSSI Falloff Wait Time 4 sec

Low RSSI Threshold 25

RSSI Check Frequency 3 sec

Lower Transmit Rates

Transmit rates can be adjusted in the Advanced tab of SSID under your VAP profile.

Remember that the basic rates are a subset of the transmit rates. If you only want to allow speeds 9 and up, you would select only the transmit rates of 9 and up, and the basic rates of 9 and 11

Hotspot 2.0

default

net-wireless

802.11g Basic Rates

802.11g Transmit Rates

<input type="checkbox"/>	1	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>	5	<input type="checkbox"/>	6	<input checked="" type="checkbox"/>	9	<input type="checkbox"/>	11	<input checked="" type="checkbox"/>	12
<input type="checkbox"/>	18	<input type="checkbox"/>	24	<input type="checkbox"/>	36	<input type="checkbox"/>	48	<input type="checkbox"/>	54				
<input type="checkbox"/>	1	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>	5	<input checked="" type="checkbox"/>	6	<input checked="" type="checkbox"/>	9	<input checked="" type="checkbox"/>	11	<input checked="" type="checkbox"/>	12
<input checked="" type="checkbox"/>	18	<input checked="" type="checkbox"/>	24	<input checked="" type="checkbox"/>	36	<input checked="" type="checkbox"/>	48	<input checked="" type="checkbox"/>	54				

Local Probe threshold

Local Probe threshold can be adjusted in the advanced tab of SSID under your VAP profile.

Depending on the density of your APs consider values between 20 and 40 -- 40 being aggressive in an AP dense area.

Hotspot 2.0

default

net-wireless

Local Probe Request Threshold (dB)

30

Deny Broadcast Probes

Denying Broadcast Probes can cause problems with Roaming especially if the SSID is hidden – leave option disabled.

Hotspot 2.0

default

net-wireless

Hide SSID

Deny_Broadcast Probes

Local Probe Request Threshold (dB)

30