White Paper

Preparing Your Cisco Unified WLAN for Cisco Cius

This white paper provides an overview of the advanced Cisco Unified Wireless LAN features to support the audio and video Wi-Fi channel capacity for Cisco Cius™ business tablets. The Cius has 802.11n single-spatial-stream support on both the 2.4-GHz and 5-GHz Wi-Fi bands. This is typical of 802.11n-enabled smartphones and tablets with cellular radios, while better powered laptops have multiple spatial streams. Cisco Cius supports Cisco Compatible Extensions features for fast secure roaming and power saving, and 802.11e for voice and video quality of service. This paper focuses on designing a well-managed network for reliable call and application performance.

The primary concern with today's 2.4-GHz Wi-Fi WLANs is interference that robs the channel of capacity. There are two types of interference. One type, called co-channel interference, comes from neighbor access points or nearby rogue access points. The second is non-Wi-Fi interference caused by radios in microwaves, Bluetooth devices, surveillance cameras, and single-mode handsets. Similar conditions do occur in 5 GHz but generally to a lesser degree. This is a condition that is best managed by Cisco CleanAir technology, Cisco's spectrum intelligence feature.

How Cisco CleanAir Supports Cisco Cius Performance

Non-Wi-Fi interference removes bandwidth from the Wi-Fi channel and therefore needs to be managed to provide reliable capacity. Cisco Aironet® access points that have spectrum intelligence include a separate spectrum radio for both Wi-Fi bands, in addition to 802.11n radios. These access points provide simultaneous spectrum analysis of the 2.4-GHz band and the 5-GHz band while providing optimum Wi-Fi support to both bands. The CleanAir feature allows the system to report the location of the interference relative to nearby access points by non-Wi-Fi device type. This enables quick removal of the interfering source. Secondly, spectrum intelligence reports the channel utilization of the offending interferers.

Cisco CleanAir provides a means to monitor and identify interference in the Wi-Fi channels. The source of the interference still needs to be removed when possible. When the interfering devices cannot be removed, Cisco radio resource management (RRM) can dynamically arrange Wi-Fi channel coverage to improve channel performance. But removing interfering devices is the better solution for reclaiming bandwidth.

The Mobility Services Engine is a key component of, and deeply integrated with, the industry-leading Cisco CleanAir Technology. Without MSE, CleanAir allows you to create a self-healing wireless network that automatically detects and mitigates RF interference. By adding an MSE to CleanAir, you gain physical location information of wireless interferers on a floor map, detailed interference history for forensic analysis, and system-wide alert correlation across many controllers and access points, to provide a single, intelligent alert to IT managers for quick troubleshooting.

Cisco Cius Support for Cisco Compatible Extensions Features

The Cisco Compatible Extensions program ensures the widespread availability of client devices that are interoperable with a Cisco WLAN infrastructure and take advantage of Cisco innovations for enhanced security, rich media mobility, quality of service, and network management. The Cisco Cius tablet is similar to leading smart (dual-mode) phones in that it is optimized to work with a Cisco Wireless LAN (WLAN) infrastructure, supporting the latest WLAN standards and Cisco innovations. Some of the highlights of the Cisco Compatible Extensions specifications are access point assisted roaming with fast 802.1x re-authentication, management frame protection, unscheduled automatic power save delivery, and location awareness.

Cisco Cius takes advantage of advanced features provided by Cisco Compatible Extensions to reduce roaming time, especially when the user is moving and in an active call or data connection. By supporting 802.1x Cisco Centralized Key Management (CCKM) with Wi-Fi Protected Access 2 (WPA2), Cius has superior roaming performance between Wi-Fi access points in the same network, with an average of 70 ms roam time in most deployments. A large delay in roaming manifests as voice gaps or clicking sounds as the non Cisco Compatible Extensions clients roam from one access point to another. This feature also reduces processing on authentication servers related to Wi-Fi roaming.

In addition, as part of the Cisco Compatible Extensions Version 5 specifications, management frame protection (MFP) protects against network disruption caused by malicious systems that forge disassociation or de-authentication requests. Cisco Wireless LAN infrastructure protects management frames transmitted when Cius is associated and authenticated. Non-protected WLANs can send management information in unprotected frames, which makes them vulnerable to attack.

Table 1 provides a short list of the top Cisco Compatible Extensions features supported by Cisco Cius tablets.

Table 1. Cisco Compatible Extensions Features Supported by Cisco Cius

Version 4 Specifications	Cisco Compatible Extensions Features	Benefits	Cius Support
S50	CCKM support for Extensible Authentication Protocol (EAP) types	Locally cached credentials means faster roams	Yes
S55	Unscheduled Automatic Power Save Delivery (U-APSD)	More channel capacity and better battery life	Yes
S54	TSPEC-based Call Admission Control (CAC)	Managed call capacity for roaming and emergency calls	No (Use Session Initiation Protocol [SIP] CAC)
S56	Voice Traffic Stream Metrics (TSM)	Better and more informed troubleshooting	Downlink only
S51	Neighbor List (Cisco RRM-based)	Reduced client channel scanning, resulting in faster roaming and better battery life	Yes
S31	Dynamic Transmit Power Control (DTPC)	Improved battery life by clients learning their transmit power level from the access point	Yes
S32	Assisted Roaming	Faster Layer 2 roams	Client managed

Features That Improve Channel Bandwidth for Cisco Cius

Spectrum Intelligence is the recommended tool to manage bandwidth robbing interference. There are three other Cisco features that help provide better 2.4-GHz channel bandwidth.

Cisco BandSelect Technology

Cisco BandSelect makes use of the channels and bandwidth available in the 5-GHz Wi-Fi band. This feature directs a client that is capable of using both Wi-Fi bands to associate to the access point on the 5-GHz band. This does two things for the 2.4-GHz band: it provides more bandwidth for the access point and reduces co-channel interference for nearby access points.

Cisco ClientLink Technology

Cisco ClientLink technology is available on all Cisco 802.11n Aironet access points. Cisco recommends that you enable ClientLink on both the 2.4-GHz and 5-GHz bands. This beam-forming feature reduces retries by 50 percent for 11g and 11a video call transmissions, thereby increasing bandwidth while reducing jitter. For ClientLink to work, each of the three receive radios per band on the access point must receive the client signal with similar signal strength, which, in turn, requires the attached antennas to be the same and in the same location. Cisco antennas are recommended for beam-forming support that provides optimum signal-to-noise (SNR) at the client radio.

Maximum Ratio Combining Technology

Cisco access points use three antennas to process received signals into one reinforced signal by adjusting their phases and amplitudes to form the best possible signal. The algorithm it uses, called maximal ratio combining (MRC) helps in the uplink direction, enabling the access point to “hear” the client better. MRC helps to provide to provide the optimal SNR at the access point.

Removing Legacy 802.11 Data Rates to Increase Channel Bandwidth

Increased Bandwidth

The most effective way to increase channel bandwidth in the 2.4-GHz band is to remove legacy data rates. Access point density can only be increased to a point with legacy data rates enabled before co-channel interference reduces bandwidth. Co-channel interference is Wi-Fi traffic from nearby client devices and access points. To improve 2.4-GHz bandwidth, Cisco recommends that you evaluate the number on clients in your network that are not 802.11g-capable.

802.11g was ratified in 2003 and clients that are compliant with the IEEE standard were introduced in 2001. With 10 years of orthogonal frequency division multiplexing (OFDM) modulation clients, there may be no need to support the legacy 802.11 and 802.11b data rates, particularly in enterprise and education settings. A configuration without legacy data rates reduces co-channel interference, greatly increasing bandwidth in dense access point deployments. There is virtually no reason to have 1 Mbps enabled or required.

Reviewing the list of clients associated on your Cisco Wireless LAN Controller (WLC) reveals which clients are 802.11 or 802.11b. Removing the 802.11 1-Mbps and 2-Mbps data rates has changed the channel utilization from 40 percent to 5 percent at sites with 35 foot access point spacing. At a channel utilization of 35 percent, the channel is so busy that 802.11 back-off algorithms are in effect for virtually all packets to be transmitted, regardless of 802.11e quality-of-service (QoS) configurations.

Faster Streaming Video

Video streaming using multicast is improved when legacy data rates are removed because multicast traffic is sent at the slowest mandatory data rate. Legacy 802.11 clients require a mandatory data rate no faster than 2 Mbps, and 802.11b clients require a mandatory data rate no faster than 11 Mbps.

Another Cisco recommended feature is media stream multicast direct. If legacy data rates cannot be removed and your network has multicast applications, configuring multicast direct will transform the multicast data rate packets into unicast packets that are sent at data rates specific to the client capabilities and range. With multicast direct configured, an 802.11n smartphone or tablet can receive video streams at 144 Mbps instead of 2 Mbps.

Using Media Session Snooping with SIP CAC with Cius

Media session snooping should be enabled for the Cisco Cius WLAN. The initial release of Cisco Cius supports 802.11e packet marking for voice and video packets but does not make use of TSPEC for Call Admission Control (CAC). Enabling the Media Session Snooping option makes it possible to have SIP voice and video CAC logic manage channel bandwidth subscription. CAC for voice and CAC for video work to keep the Wi-Fi channel from being oversubscribed with client requests for bandwidth. CAC encourages a client that is not granted bandwidth requests to seek a channel that has adequate bandwidth. Cisco Wireless LAN Controller (WLC) Software Version 7.0 .98.0 or later is recommended for SIP Video CAC.

How to Test Wi-Fi Coverage for Cius

To evaluate your current network coverage suitability for Cisco Cius, it is recommended that you do a walk around the site with a live call on a similar device, such as an 802.11n-capable smartphone. Smartphones and tablets have a single antenna support. You don't want to test with a multiple-input multiple-output (MIMO) client because the transmit range will be better.

The test should be done with a WLAN/service set identifier (SSID) that is not used for daily operations. This way the WLAN can be enabled for either 2.4 GHz or 5 GHz. It is important to find the phone's coverage performance for both bands. With a test WLAN, the coverage of the site should be checked with only the 2.4-GHz band enabled. Then repeat the test with only 5-GHz enabled. Cisco ClientLink should be enabled for the tests.

The link quality to the access point is most important. On the Cisco WLC client statistics page, you can check the strength of the phone's signal to the access point. The signal strength is reported in dBm in the received signal strength indicator (RSSI) field. An RSSI value of -67 dBm on the access point indicates that the phone is at the edge of coverage where you can expect a good mean opinion score (MOS) value. A value of -67 dBm is equally applicable for 802.11n devices. There still are bandwidth and jitter considerations that will reduce the MOS value, but from a signal perspective, -67 dBm is the design goal.

A live call to a Cisco desk phone is the best way to evaluate mobile call quality. The desk phone has a real- time MOS value, packet lost and jitter reporting which can be accessed by looking up the Call Statistics under Device Settings. A person at the desk phone can hear the call quality and at the same time monitor the statistics on the desk phone and the Wi-Fi statistics, including RSSI reported on the WLC. In addition, the person at the desk phone can make notes on a floor plan if there are areas of poor performance.

How to Manage a Cisco Cius Capable Wireless Network

Designing a wireless LAN that effectively supports business-critical data, voice, and video services is simplified with the Cisco Wireless Control System (WCS) suite of built-in planning and design tools. As an aid to the thorough pre- and post-deployment site surveys required for any Cisco Cius deployment, Cisco WCS planning and design tools simplify the process of defining access point placement and determining access point coverage areas for both standard and irregularly shaped buildings. They also enable immediate assessment of the WLAN's readiness to support voice and video over WLAN for Cius. Most problems with wireless networks stem from the improper design and deployment as it relates to RF propagation and poor access point placement.

Another common cause of poor call quality and other network-related issues is an incorrect configuration of the Cisco Wireless LAN Controllers in the environment. WCS also comes bundled with a VoWLAN Audit Tool. You can use this tool to validate the controller configuration against deployment guide recommendations or the preconfigured criteria for a given environment. after optimization has occurred.

Other Cius Wi-Fi Considerations

Bluetooth

Cisco Cius is Bluetooth capable. There will be the obvious attraction to add a Bluetooth ear bud, Bluetooth keyboard and Bluetooth mouse. The Cius is designed to hand off a call to Wi-Fi that is started while the device is docked and running on Ethernet. This means that when the Cius tablet is being undocked, it will be transferring the call to Wi-Fi when the device is moving away from the Bluetooth accessories. This will hamper the transition to Wi-Fi if the call is transitioning to 2.4 GHz.

The Cius can also transfer a call from Wi-Fi when it is being docked. When this happens there may be up to three Bluetooth accessories trying to pair to the Cius. In an area where there is a high density of users, Bluetooth usage should be discouraged because simultaneous pairing of just three Bluetooth devices can cause a 2.4-GHz VoWLAN call to drop. It is therefore recommended that 5 GHz be the primary Wi-Fi WLAN for Cius in an area with a high density of users.

5-GHz Band

If there are known future application deployments that may include Cius, they too should be considered in capacity planning. The 5-GHz spectrum provides the most flexible method of high-bandwidth design as there are 21 channels available in the 5-GHz spectrum. These channels do not have frequency overlap as is the case with the 2.4-GHz spectrum. Therefore, 21 access points could share the same floor space and not interfere with each other or the clients associated with them when in 5-GHz 802.11a mode. The 5-GHz 802.11n wide channel mode (40 MHz) provides for nine non-overlapping channels. When standard 20-MHz wide channels in the 5-GHz 802.11n band are used, there are 21 non-overlapping channels just as in 802.11a. Many 802.11a clients do not support all the available 5-GHz channels. It may be necessary to exclude certain channels from RRM dynamic assignment.

Cisco Cius can operate in 20-MHz wide channel and 40-MHz channel mode. This allows the Cius to be fully functional alongside an Intel laptop that is performing at 300-Mbps data rates. The Cius has the same range on a 40-MHz wide channel as a 20-MHz channel.

Summary

Cisco Unified Wireless Network hardware and software provide superior support for the rich media demands of Cisco Cius. With advanced Cisco Compatible Extensions providing reliable and robust connectivity, to innovations in spectrum analysis and interference mitigation provided by Cisco CleanAir technology, the Cisco Cius tablet performs better on a Cisco Unified Wireless Network platform.

Reference Links

- Is Your WLAN Ready for Voice?
  http://www.cisco.com/en/US/solutions/collateral/ns340/ns394/ns348/net_implementation_white_paper0900aecd80472e80.html
- Optimize the Cisco Unified Wireless Network to Support Wi-Fi Enabled Phones and Tablets
  http://www.cisco.com/en/US/solutions/collateral/ns340/ns394/ns348/ns767/white_paper_c11-634584.html
- Optimizing Enterprise Video Over Wireless LAN
  http://www.cisco.com/en/US/prod/collateral/wireless/ps6302/ps8322/ps10315/ps10325/white_paper_c11-577721.html
- VoWLAN Site Survey and RF Design Validation
  http://www.cisco.com/en/US/docs/wireless/technology/vowlan/troubleshooting/8_Site_Survey_RF_Design_Valid.html
- Voice and Video White Papers
  http://www.cisco.com/en/US/netsol/ns736/networking_solutions_white_papers_list.html
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  http://www.cisco.com/en/US/docs/solutions/Enterprise/Mobility/vowlan/41dg/vowlan41dg-book.html
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