

Cisco Wireless ClientLink 3.0 Technology

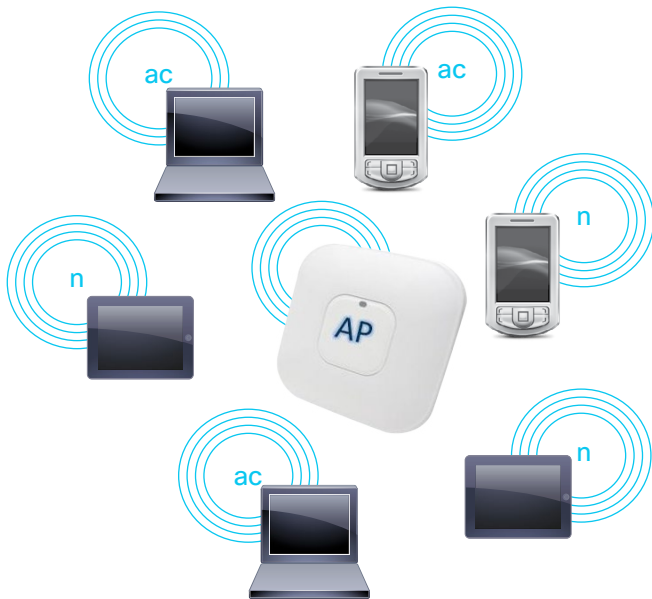


Cisco ClientLink 3.0 Optimizes Wireless Client Performance

With bring your own device (BYOD), a proliferation of client devices has started to penetrate the enterprise wireless landscape. The “proliferation of client devices” generally refers to the various types of wireless clients accessing the network: smartphones, laptops, tablets, etc. Across these clients, different wireless standards are used to access the wireless network: IEEE 802.11a, 802.11g, 802.11n, and the newest standard, 802.11ac. The 802.11ac standard provides an increase in performance for devices, and the performance can further increase if these devices support one, two, or even three spatial streams. However, legacy 802.11a/g clients often hinder the network’s ability to take advantage of the additional performance gains of 802.11ac. With this mixed environment of legacy clients such as 802.11a/g and 802.11n with one, two or three spatial streams, network infrastructures must be able to support a varying combination of different wireless standards (Figure 1).

Cisco® ClientLink 3.0 technology specifically focuses on mixed-client networks, optimizing overall network capacity by helping ensure that 802.11a/n and 802.11ac clients operate at the best possible rates, especially when they are near cell boundaries.

Figure 1. The Mixed-Client Wireless Network



The Mixed-Client Wireless Network

IEEE 802.11ac provides remarkable performance improvements in the areas of throughput, link reliability, and predictability for wireless networks. Although 802.11ac technology provides significant benefits, organizations must continue to support mixed-client networks. Client lifecycles range from three to five years. To maximize return on investment, businesses will see their 802.11n clients through to the end of their lifecycles before transitioning to the newer, 802.11ac-based clients with varying support for spatial streams and increased performance.

Mixed-client networks do not optimize legacy client lifecycle utilization, and consequently the older 802.11a/n clients delay communications for the faster 802.11ac clients, reducing overall system performance capability.

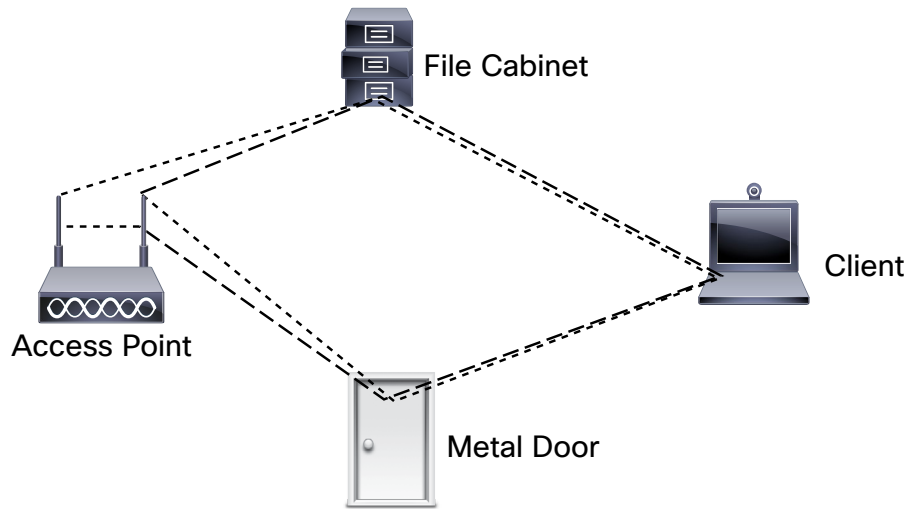
Cisco ClientLink 3.0 overcomes this challenge by optimizing the overall system performance of mixed-client wireless networks. Many 802.11ac solutions offer improvements only in the uplink communication from client to access point. Cisco ClientLink technology is unique: It offers uplink communication improvements as well as efficient downlink communication from access point to client. Enhanced downlink throughput offers better performance in daily traffic usage such as web browsing, email, and file downloads. This improvement in downlink throughput for the slower, legacy 802.11a/n clients improves the experience not only for 802.11a/n clients, but also for the balance of other clients on the network. The result is a more reliable mobile experience with increased network capacity.

Multiple Antennas Work for All Clients

In a typical indoor WLAN deployment at an office, school, hospital, or warehouse, the radio signal rarely takes the most direct, shortest path from transmitter to receiver because walls, doors, or other structures obscure the line of sight. Luckily, most of these environments are full of surfaces that reflect a radio signal similarly to the way a mirror reflects light. When a signal travels over different paths to a receiver, the signal traveling the shortest path arrives first, followed by copies or echoes of the signal slightly delayed by each of the longer paths. This situation is called multipath propagation (Figure 2). Multipath conditions are constantly changing as clients, people, and objects move throughout the network of access points.



Figure 2. Multipath Propagation



802.11n/ac systems take advantage of multipath by sending multiple radio signals at the same time. Each of these signals, called a spatial stream, is sent from its own antenna using its own transmitter. Because there is some space between these antennas, each signal follows a slightly different and unique path to the receiver, a situation called spatial diversity. The receiver has multiple antennas as well, each with its own radio that independently decodes the arriving signals, and each signal is combined with the signals from the other receive radios. The result is that multiple data streams are received at the same time. This enables much higher throughput than previous 802.11a/g systems, but requires an 802.11n/ac-capable client to decipher the signal.

Cisco ClientLink 3.0 uniquely opens higher-throughput capabilities for 802.11ac and 802.11a/n clients. ClientLink 3.0 integrates advanced signal processing into the wireless chipset. Like ClientLink and ClientLink 2.0, ClientLink 3.0 uses multiple transmit antennas to focus transmissions in the direction of the 802.11a/n/ac client.

ClientLink 3.0 on the Cisco Aironet® 3700, along with the Cisco Aironet 3600 and 2600 Series Access Points, surpasses the industry norm and uses four distinct transmit antennas to enhance the performance of the mixed-client 802.11a/n/ac network. This increases the downlink signal-to-noise ratio (SNR) and the data rate over range, thereby reducing coverage holes and enhancing the overall system performance.

Beamforming and Enhanced Throughput

802.11n originally specified how MIMO technology can be used to improve SNR at the receiver by using transmit beamforming. With this technique, it is possible to coordinate the signal sent from each antenna so that the signal at the receiver is improved. However, both the access point and the client need to support this capability.

Cisco ClientLink 2.0's innovative beamforming capability improves SNR for all 802.11 clients. ClientLink 2.0 technology takes the industry norm one step further and improves performance in the downlink direction, making any client better able to hear the access point. The wireless channel is reciprocal, meaning that the transmission path from the access point to a client, and from that same client to the access point, have sufficient similarity in each direction. Thus the access point can use the adjustments calculated by a maximal ratio combining algorithm (referred to as "weights") to optimize the reciprocal signal transmitted back to that specific client using the access point's four transmit antennas. This technology essentially learns the optimum way to combine the signal received from a client, and then uses that information to send packets in an optimum way back to the client.

Cisco ClientLink 3.0 beamforming technology enables the access point to optimize the SNR exactly at the position where the client is placed. Improved SNR yields many benefits, such as a reduced number of retries and higher data rates. By allowing the wireless system to operate at higher data rates and with fewer retries, ClientLink 3.0 increases the overall capacity of the system, which means more efficient use of spectrum resources.

For 802.11ac clients, especially those that support two or three spatial streams, spatial multiplexing is used to deliver enhanced high-throughput data rates upwards of 1300 Mbps. In this manner, the optimum MIMO technology is dynamically selected to deliver benefits to each client type and their needs.

Additionally, because this technology does not depend on any client-side hardware or software capabilities, it works with the complete mixed-client network. ClientLink 3.0 interoperates seamlessly in mixed-mode environments where 802.11ac and 802.11a/n clients coexist on the same access point.



Summary

Cisco ClientLink 3.0 technology helps solve the problems of mixed-client networks by making sure that older 802.11a/n clients operate at the best possible rates, especially when they are near cell boundaries while also supporting the ever-growing 802.11ac clients that support one, two, or three spatial streams. Unlike most 802.11ac access points, which improve only uplink performance, Cisco ClientLink 3.0 improves performance on both the uplink and the downlink, providing a better user experience during web browsing, email, and file downloads. ClientLink 3.0 technology is based on signal processing enhancements to the access point chipset and does not require changes to network parameters.

Cisco ClientLink 3.0 allows businesses to transition to 802.11ac at their own pace. They can continue to work within the lifecycles of their existing legacy wireless 802.11a/n clients while optimizing the throughput and performance of all clients.

	Competitors	ClientLink 1.0	ClientLink 2.0	ClientLink 3.0
Beamforming Type	Standards	Beyond Standards	Standards and Beyond Standards	Standards and Beyond Standards
Access Points Supported	Most 802.11n	1140, 1260, 3500	3600, 2600, 1600*	3700
No. of Transmitters to Improve Reliability for Downlink Traffic	2-3	2	4 for the 3600 3 for the 2600/1600	4
Clients Supported	802.11n	802.11a/g	802.11a/g/n	802.11a/g/n/ac
No. of Clients Supported per radio	-	15	128*	128
Optimized for iPhone, iPads (1x1:1SS, 11n)	No	No	Yes	Yes
Optimized for Newer Laptops from Apple, Dell, Lenovo, HP (3x3:3SS, 11n)	No	No	Yes	Yes
Ready for Mobile Devices Influx (BYOD)	No	No	Yes	Yes

*ClientLink 2.0 on 1600 is limited to 32 clients, and only 1x1:1SS MIMO clients