LANCOM™ Techpaper Active Radio Control

Introduction

The rapid increase of WLAN-enabled end devices proves: the advantages of a flexible design of wireless networks gain in popularity – especially in enterprises. However, the more clients have to be supplied with WLAN, the more complex the required WLAN infrastructure becomes. For an efficient, wireless workflow a professional WLAN management is essential in order to provide a high-performance throughput for clients and to prevent sources of interference. However, network administrators are faced with multiple challenges:

- Many WLANs overlap each other on individual channels
- WLAN clients compete for the available bandwidth
- WLAN clients associate with far-off access points
- Foreign WLANs disturb the own radio field
- Other non-WLAN sources of interference temporarily compromise the performance of the WLAN – up to total failure

With the intelligent WLAN optimization concept LANCOM Active Radio Control (ARC) you optimize your radio field and proactively prevent sources of interference in the WLAN. Active Radio Control comprises several, complementary functionalities in the LANCOM firmware LCOS, enabling you to sustainably improve the performance of your WLAN.

This techpaper introduces the functionalities of Active Radio Control and provides short instructions to professionally optimize WLAN infrastructures.

LANCOM | Active Radio Control

Full control over the WLAN

LANCOM Active Radio Control provides the following professional and practical functionalities that optimize the WLAN radio field:

- Adaptive RF Optimization
- Managed RF Optimization
- Airtime Fairness
- Band Steering
- Client Steering
- Adaptive Noise Immunity
- Spectral Scan

All ARC functionalities are included free of charge in the LANCOM firmware LCOS and can be operated via the respective management systems.

Adaptive RF Optimization

By choosing a WLAN channel, the part of the frequency band an access point uses for its logical WLANs is defined. In order to flawlessly operate a WLAN in reach of another access point, each access point should be using a separate channel – otherwise the WLANs have to share the bandwidth of the channel (shared medium). For this purpose, LANCOM access points use the feature Adaptive RF Optimization: The access point permanently scans the radio field for interfering signals. If a certain threshold has been exceeded in the currently used WLAN channel, the access point automatically changes to a qualitatively better channel. This intelligent functionality enables the access point to dynamically adapt to an ever-changing radio field in order to maximize the WLAN's robustness.
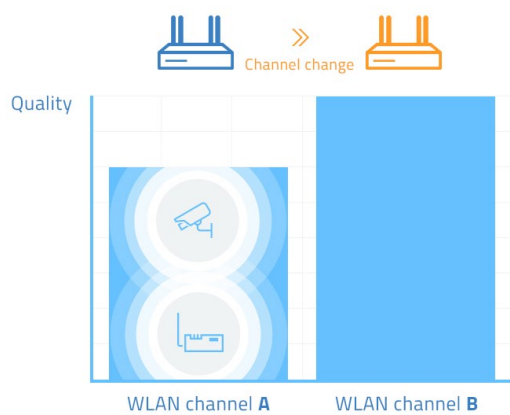

Figure 1: Adaptive RF Optimization

Configuration

Adaptive RF Optimization is activated via LANconfig: Therefore, you select in the section Wireless LAN > General > Physical WLAN Settings the required radio module and activate the function in the slider "Adaptive RF Optimization".

Managed RF Optimization

With Managed RF Optimization the administrator can also trigger the configuration of optimal WLAN channels via a WLAN controller. In the first step, the channel lists of the access points are deleted and prepared for a new definition. After that, the WLAN modules are shut off and successively turned on again. In turning on, the modules automatically search for a free channel and thus optimize the distribution of the channels in the radio field. The module with the highest measured interference is prioritized for channel selection. RF Optimization can be activated for all access points managed by a WLAN controller or specifically for individual devices.
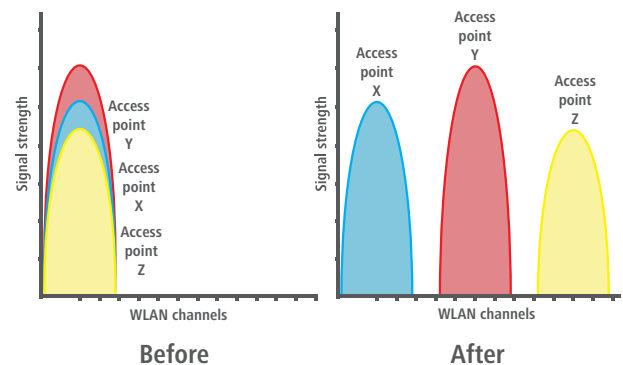

Figure 2: Managed RF Optimization

Configuration

Managed RF Optimization is started easily via LANmonitor: with a right mouse click on the list of active access points or on a specific device you choose "Start automatic radio field optimization" from the context menu.

Airtime Fairness

Especially in WLAN scenarios with a high client-density, the devices compete for the available bandwidth. Thereby the sending opportunities are passed around the active clients – without considering necessary transmission times. This leads to slower (legacy) clients slowing down faster clients during the transmission of data packets, although the faster ones could quickly finish their data transmission. The feature Airtime Fairness ensures that the available bandwidth is efficiently used. For that purpose, WLAN transmission times ("airtimes") are fairly distributed among the active clients. The consequence: Thanks to all clients being provided with the same airtime, faster clients can achieve more data throughput in the same amount of time accordingly.
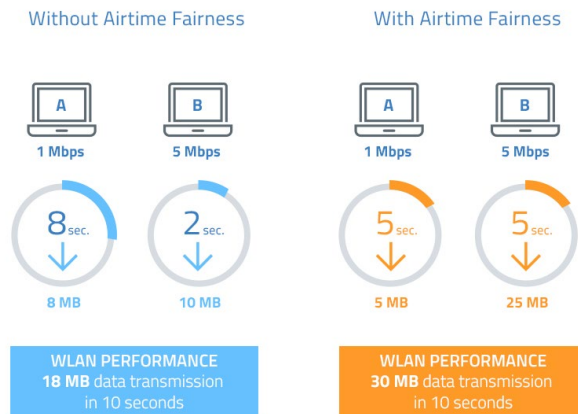
Figure 3: Airtime Fairness

Figure 4: Band Steering

Configuration

Airtime Fairness is activated by default for all WLAN modules. In addition to that the mode can be adapted for special cases via LANconfig: Go to Wireless LAN > General > Physical WLAN Settings and select the radio module and go to the tab Performance where you can set the Airtime Fairness mode for the chosen radio module.

Band Steering

Due to the higher distribution of clients supporting 2.4 GHz WLAN, a WLAN operating on this frequency band can be heavily loaded by a large number of clients. This is further increased by clients which do support 5 GHz but preferably log in via 2.4 GHz. In consequence the available bandwidth at 2.4 GHz is shared by many clients, while there is still enough capacity at 5 GHz. In order to achieve a more equal load in the WLAN and thus a more stable and faster connection for all clients, Band Steering is an efficient solution. The access points have to transmit the same SSID at both 2.4 GHz and 5 GHz. Therefore Band Steering can only be utilized by access points with two radio modules. When a client establishes contact, the access point checks its internal data whether the client has already been seen in the 5 GHz frequency. If this is the case, the access point will not answer probe requests of the client at 2.4 GHz and instead only answer via 5 GHz. This way, the client is effectively steered towards the 5 GHz frequency band.

Configuration

The configuration of Band Steering for LANCOM access points or WLAN controllers is conducted comfortably via LANconfig. The necessary settings are found under Wireless-LAN > Band Steering. Here you can choose the preferred frequency band and activate Band Steering. Note: Make sure that the same SSID is configured on both 2.4 GHz and 5 GHz.

Client Steering

Thanks to an active steering of WLAN clients to the most ideal access point, the WLAN performance in controller-based networks is significantly increased. Especially in WLAN scenarios with a high number of end devices, Client Steering is ideal for an optimized load balancing. Depending on predefined scenarios or individually set parameters such as signal strength, frequency band or number of associated clients, end devices are associated to the most suitable access point and thus benefit from the full bandwidth potential. All of this takes places automatically, without the need of changing the clients' configurations.
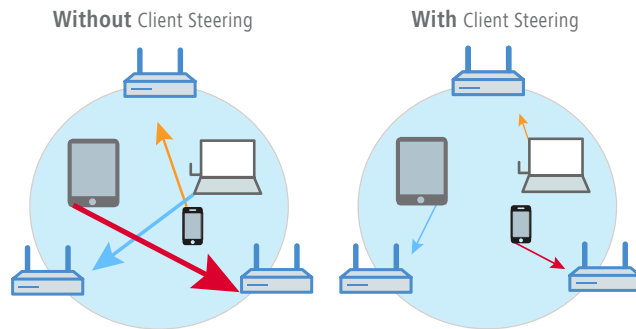
Without Client Steering   **With** Client Steering

Figure 5: Client Steering – based on signal strength

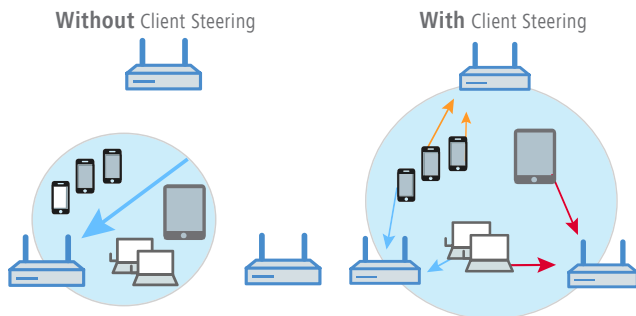**Without** Client Steering   **With** Client Steering

Figure 6: Client Steering – based on number of connected clients

probability is increased that the WLAN module will ignore intereferences while searching a free transmission slot, due to the "Carrier Sense Multiple Access / Collision Avoidance" procedure. These adaptive changes of the reception sensitivity, based on the permanent check of the radio field, the optimal operation of the WLAN module is induced.

Figure 7: Adaptive Noise Immunity

Configuration

Client Steering is configured via the WLAN controller and is activated by default. If further adjustments for individual access points are required, they can be implemented to new or existing Client Steering profiles via WLAN Controller > AP Configuration > Client Steering Profiles.

Adaptive Noise Immunity

WLANs often operate in challenging environments with many different sources of interference, compromising the performance of the own WLAN. Potential sources of interference may be other WLAN signals or other radio signals such as Bluetooth devices, wireless cameras, and microwave ovens which may have significant influence on the WLAN. By activating Adaptive Noise Immunity, an access point ignores sources of interference in the radio field and only focuses on WLAN clients with sufficient signal strength. This process is based on measured values of the WLAN module with regard to interferences in the radio field. If a defined threshold is exceeded, the reception sensitivity of the WLAN module will be reduced by LCOS respectively. Therefore, the

Configuration

You can activate or deactivate Adaptive Noise Immunity with just one click in LANconfig under Wireless-LAN > General > Interfaces > Physical WLAN settings. Adaptive Noise Immunity is activated for both the 2.4 GHz and 5 GHz frequency bands by default.

Spectral Scan

Despite activated Adaptive Noise Immunity, the WLAN performance may be compromised by further sources of interference, especially in the 2.4 GHz frequency band. Interferences range from microwave ovens, wireless phones, Bluetooth devices or video transmitters, sending signals via 2.4 GHz. Such interferences can lead to the loss of data packets or of entire connections. If the overlap is too strong, the result may even be total failure of the WLAN. Spectral Scan enables a professional analysis of the radio field. The load of individual channels at a certain point of time is graphically illustrated and can be monitored historically. This way, the administrator can detect that a certain channel in the 2.4 GHz frequency band is heavily

loaded during a certain time period. The conclusion could be that a source of interference has been operating during this time period, for instance a microwave oven during lunch time or a gaming console. With this information the administrator can take countermeasures by changing the used channel or by eliminating the source of interference. In contrast to a fully automated, program-controlled switching of channels, this active intervention by the administrator has clear advantages: no undesirable configuration changes occur, for instance by switching to an already heavily loaded channel. Another advantage is the possibility to start Spectral Scan via WEBconfig – ideal for a remote operation without a technician on-site.

Figure 8: Spectral Scan

Configuration

Spectral Scan can be easily started via LANmonitor. Right-click the respective device in the list and select "Show Spectral Scan" in the context menu. Here you select the WLAN module to be analyzed as well as the sub-band, if necessary. With a click on "Start" you activate Spectral Scan. Note: During the analysis the scanning WLAN module neither transmits any data, nor an SSID.

Outlook

A professional WLAN optimization does not have to be complicated or expensive. All features of LANCOM Active Radio Control are included in the LANCOM firmware LCOS and are easily operated via the respective management tools. Thus they are free of charge and updated regularly.
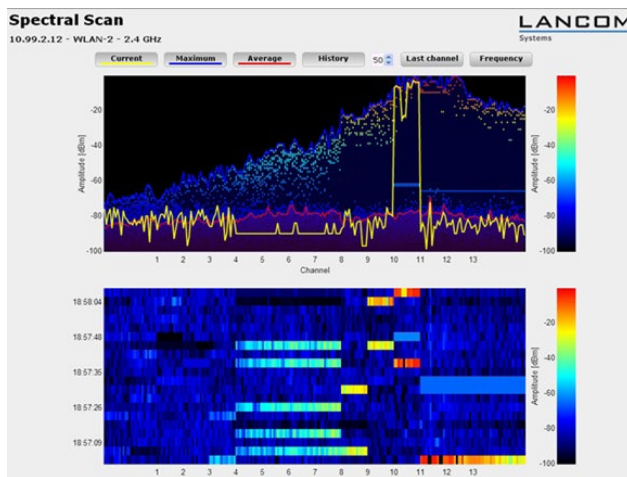
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