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## **ISSUES OF WIRELESS LOCAL AREA NETWORK (WLAN)**

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### **Abstract:**

Wireless Local Area Network (WLAN) represents a progression of technology and become one of the most essential and indispensable part of our life style due to their ease in usage and applicability. Increased usage of WLAN, users developed high expectations on the system and will not accept too much degradation in performance to achieve mobility and flexibility. This paper is an attempt to explore the concept of WLAN and study the issues of WLAN in term of Radio Frequency (RF) propagation topology level and configuration level. Methodology includes the identification of issues related to the RF propagation and configuration level at work place with the help of Air Magnet's survey Pro and provide recommendations to resolve the issues arises as hurdle in the work functioning.

**Key words:** Wireless Local Area Network (WLAN), Radio Frequency (RF)

### **INTRODUCTION:**

A wireless local area network (WLAN) is a wireless computer network that links two or more devices using a wireless distribution method (often spread-spectrum or OFDM radio) within a limited area such as a home, school, computer laboratory, or office building. This gives users the ability to move around within a local coverage area and yet still be connected to the network. A WLAN can also provide a connection to the wider Internet.

### **REVIEW OF RELATED LITERATURE:**

Singh, Vaish&Keserwani (2014) studied research issues and challenges in the wireless domain, taxonomy of wireless network, overview of a comprehensive list of research issues and challenges of the wireless network like signal fading problem , mobility problem ,power and energy , data rate enhancement, security and the quality of service issues problems of the wireless networks in paper entitled " Research issues and challenges of wireless networks".

In addition the popularity of wireless networks growing at an exponential rate, the data rate enhancements, minimizing size, cost, low power networking, user security and the best requirement to obtain the required Quality of Service. problems become more challenging because wireless networks are rapidly becoming popular, and user demand for useful wireless applications is increasing.

Florwick, Whiteaker, Amrod&Woodhams (2013) designed a guide entitled "Wireless LAN Design Guide for High Density Client Environments in Higher Education" which provides engineering guidelines and practical techniques for designing, planning, and implementing a wireless LAN (WLAN) within a high-density environment in a university or college campus. Here, High-density is defined as any environment with a large concentration of users, such as a classroom, lecture hall, or auditorium where the users are connected wirelessly, sharing applications and using other network services individually.

Administrators are finding themselves faced with the challenge of providing ever-increasing levels of service in areas where simple pervasive coverage was the singular design goal. Simply adding more access points (APs) often does not enhance service. The design guide focuses on the challenges facing administrators deploying WLANs in higher education and offers practical strategies and design guidance for evaluating and modifying current deployment strategies, improving performance with existing resources, and successfully scaling network accessibility in high-density venues.

The basic nature of radio frequency (RF) is generally unchanged. Increasing the number of users who can access the WLAN in a small physical space remains a challenge. The steps and process for a successful high user density WLAN design that can be proven, implemented, and maintained using Cisco's Unified Wireless Network architecture is detailed. It includes these general steps:

- Plan: Determine application and device requirements such as bandwidth, protocols, frequencies, service level agreement (SLA), etc.
- Design: Determine density, cell sizing, antennas, coverage, site survey, etc.
- Implement: Install, test, tune, establish baseline, etc.
- Optimize: Monitor, report, adjust, review baseline for SLA.
- Operate: Cisco Wireless Control System (WCS) monitoring, troubleshooting tools, capacity monitoring and reporting tools, etc.

The general concepts underlying high-density Wi-Fi design remain true for many environments. But it is important to note that the content and solutions presented here will not fit every WLAN design scenario.

Researchers also point out the issue of interference in the radio transmissions. As wireless networks are reliable, but when interfered with it can reduce the range and the quality of the signal. Interference can be caused by other devices operating on the same radio frequency and it is very hard to control the addition of new devices on the same frequency. Usually if your wireless range is compromised considerably, more than likely, interference is to blame. (Laudon)

## **ISSUE OF WLAN:**

The study was done in order to identify the issues of WLAN in terms of Radio Frequency (RF) propagation topology level and configuration level at IT support work place.

## METHODOLOGY:

Test the signal propagation characteristics, coverage area and signal quality **Methodology**



Identify performance issues in the existing wireless network



Conduct WLAN assessment



Propose necessary recommendation to streamline the wireless network



Propose an optimal design that shall ensure:

- All the locations under scope are covered with good signal
- Seamless connectivity with no wireless disconnections
- Client load is distributed across the wireless network to avoid network choking.

## DATA ANALYSIS:

Data was collected and analysed in different parts which are as follows:

**In depth information of site:** this part consist necessary details regarding site, technical information, user device (Laptop) details and WLAN network device details.

**RF Assessment:** The survey consists of Passive and Active Surveys

**Passive survey:** During passive site survey, The Air Magnet Survey tools automatically records RF data from all the access points and stations in the surrounding areas. This provides an excellent overview of the entire wireless environment. Including sources of noise and any wireless signals from neighbouring networks. Passive survey allows any existing overload channels; potential interferes etc. from outside wireless networks.

**Active survey:** An Active site survey was performed to assess the signal coverage of the access points in the floors.

During the active site survey, Air magnet Survey tool associates to Cisco access points (SSID GCOIN) and exchange data in order to emulate the actual experience of an end-user. This enables users to map out exactly how real-world clients will perform at various locations in the site while taking into account the maintaining an active association with AP, an active survey provides the most accurate depiction of the network's actual performance as perceived by a user. Through Active survey we monitored for any drops in expected wireless signals. Identified the interference and verified network transmission speeds.

#### **GAP ANALYSIS:**

By the technical analysis existing issues of wireless networks were identified along with impact on wireless network.

As per the technical analysis, following are the issues

#### **General issues and AP placement issues**

**Issue No. 1:** AP location is not appropriate.

**Impact:** No optimal signal coverage across the floor and placed very near which creating interference.

**Summary:** 2.4GHz channels were heavily overloaded in the premises. As per regulations, Only 3 non overlapping channels could be used in 2.4 GHz. The same band was using in the adjacent floor/ Companies impacting 2.4 GHz band.

**Issue No. 2:** Access Points are placed on tables and on the floors at few places.

**Impact:** Propagation of signal coverage is abnormal as the access point pointed towards the roof will propagate the signals to the upper floor.

**Issue No. 3:** High Interference in 2.4 GHz band

**Impact:** Packet drops, disconnections, very High CRC errors and slow performance

**Issue No. 4:** No signal overlapping

**Impact:** No Seamless roaming and disconnection while in roaming.

**Issue No. 5:** Unnecessary wireless propagation in the floors

**Impact:** Creating much interference and decreasing the value of S/N ratio due to noise.

**Issue No. 6:** AP Features mismatch.

**Impact:** Disconnections during roaming and no soft hand off access point to access point.

From the survey it was found that the existing AP locations are not covering the entire floor with optimum signal, for which there is a need of more Access Points which are as follows.

### AP's Arrangement

Floor Name	Total	AIR-LAP1142N-K9	Proposed AP's	Requirement AIR-CAP3701-K9
Upper ground	8	8	13	13

### ENTERPRISE BEST PRACTICES:

#### Network Design

1. **User Port Fast on AP Connected Switch Ports:** AP's in local mode, configure the switch port with Port Fast. To configure Port Fast, set the Port to be connected as a "host" port (switch host command) or directly with the port fast command. This allows a faster join process for an AP.
2. **Interfaces Source (DHCP, SNMP, RADIUS, Multicast, and so on):** Enabling radius interference overwrites on each SSID is important to take into account when you configure firewall policies, or design the network topology. It is important to avoid configuring a dynamic interface in the same sub – network as a server that has to be reachable by the controller CPU.
3. Always configure the switch port in "access mode" for the AP's in local mode.
4. In addition, enter the switch port no negotiate command on those trucks in order to disable Dynamic Trucking Protocol (DTP).

#### Network best practices

Following are the best practices for network connectivity.

1. Reload the controllers after these changes
  - Management address
  - SNMP configuration
  - HTTPS encryption settings
  - LAG mode (enable/disable) on this case is mandatory
2. Use TAG Tagging for Management Interference
3. Does not use link aggregation (LAG) unless all ports of the controller have the same layer 2 configuration on the switch side. For example, avoid filtering some VLANs in one port. And not the others.
4. User Multicast forwarding Mode ( Use multicast forwarding mode for the best performance with less bandwidth utilization)
5. Disable Internal DHCP (the controller has the ability to provide internal DHCP server. This feature is very limited and considered as convenience that is often used simple demonstration)

#### Security

1. Disable Local EAP (Using local EAP in an enterprise production environment is not recommended. the best practice is to disable or avoid using local EAP)

2. Use AAA Override (AAA- Override feature allows you to assign per user settings. For example, move the user to either a specific dynamic interface in a separated VLAN or apply a per user Access Control List (ACL))
3. Use faster RADIUS Timeout (For 802.1x. it is recommended to have the lowest configured RADIUS timeout)
4. EAP Identify Request Timeout (In the controllers, the default timeout for the EAP Identity request may need to increase).
5. TACACS+ Management Timeout (it is best practices to increase the retransmit timeout value for TACACS+ authentication, authorization, and accounting servers)
6. Enable Infrastructure and Client Management Frame Protection (MFP) Infrastructure and client Management Frame Protection can be used to validate all 802.11 management traffic detected between nearby Access Points in the wireless infrastructure to prevent spoofing
7. Enable 802.11r Fast Transition (802.11r is the IEEE standard for fast roaming a concept of roaming, a concept of roaming where the initial authentication handshake with the target AP(i.e., the next AP that the client intends to connect to) is done even before the client associates to the target AP)
8. Enable Network Time Protocol (NTP) is very important for several features. It is mandatory to use NTP synchronization on controllers if you use any of these features; Location, SNMPv3, Access Point authentication, or MFP.
9. DHCP Requirement Option (All clients to obtain their IP address form a DHCP server)
10. Rogue Detection: There are good reasons to use rogue detection to minimize security risks, such as in a corporate environment and config .rogue detection min-rssi-70.
11. Rogue Management: Rogue wireless devices are an on-going threat to corporate wireless networks. Network owners need to do more than just scan for unknown devices, they must be able to detect, disable, locate and manage rogue/intruder threats automatically and in real time.
12. Wi-Fi Direct: Wi-Fi Direct allows Wi-Fi devices to make direct connections to one another quickly and conveniently like printing, synchronizing and sharing content. A security concern can arise for the wireless Network if the device is connected to both the infrastructure and a Personal Area Network (PAN) at the same time. Cisco recommends disallowing Wi-Fi direct clients to prevent a security hole.
13. Channels Scanning for Rogue: For a local/Flex Connect mode/Monitor mode, AP there is an option under RRM configuration, which allows the user to choose which channel is scanned for rogues, Depending on the configuration. The AP scans all channel/ country channel/DCA channels for rogues.
14. Enable Ad hoc Rogue Detection
15. Enable Rogue Client AAA Validation

### **Wireless /RF**

1. The site survey must be done with devices that must match power and propagation behaviour of the devices to be used on the real network. For example, do not use an older 802.11b/g radio with Omni antenna to study coverage if the final network uses more modern dual for 802.11a/b/g with n and 802.11ac data rates.
2. Disable Low Data Rates, for good coverage area recommended to incrementally disable lower data rates one by one. Management frames like ACK or beacons will be sent at the lowest mandatory rate (typically 1Mbps). Which slows down the whole throughput as the lowest mandatory rate consumes the most airtime.

### **Prime Infrastructure (Monitoring tool of Cisco)**

1. Empower your IT organization to more effectively manage your networks and the services they deliver with the Cisco Prime enterprise and service provider portfolios of management products.
2. Gives an integrated, comprehensive way to manage the lifecycle of wired and wireless access, along with campus and branch networks. While providing visibility into end-user connectivity and application performance, and automated IP address management.

3. Cisco Prime products deliver next- generation management by supporting an intuitive workflow-oriented user experience and integrated lifecycle operations across Cisco architectures, technologies and networks. Cisco Prime helps IT organizations.
  - Simplify network management
  - Improve operational efficiency
  - Deliver predictable services
4. Lower the total cost of ownership Platform Options
  - Physical appliance
  - Virtual appliance

### **Mobility service Engine (MSE)**

The Cisco Mobility Services Engine (MSE) helps you balance these goals. The platform gives us a centralized way to deliver WI-FI based mobility services that let us.

1. Get deep network insight. Base location services capture and aggregate key network information such as device location. RF spectrum details and RF interference sources they also let you support a rich set of real time location services (RTLS)
2. Customize mobile experience with location based services. Cisco Connected Mobile Experiences (CMX). Lets enterprises and service providers deliver customized location based mobile services to people in retail stores hospitals hotels and other venues. You can offer a personalized mobile experience and understand users better with onsite online and social analytics.
3. Keep wireless users and your network safe. Cisco MSE Adaptive Wireless Intrusion Prevention System (wIPS) helps protect the network from rogue wireless devices. Denial-of-service (DoS) attacks. And other wireless threats. It provides the tools you need to strengthen security and improve compliance.
4. Platform Options
  - Physical appliance
  - Virtual appliance

### **Identity Service Engine (ISE)**

1. Cisco Identity Service Engine (ISE) is a security policy management and control platform. It automates and simplifies access control and security compliance for wired. Wireless and VPN connectivity Cisco ISE is primarily used to provide secure access and guest access. Support BYOD initiatives and enforce usage policies in conjunction with Cisco TrustSec.
2. Maintaining network security and operational efficiency in today's distributed enterprise networks demands new technology that takes a more holistic approach to network access security.
  - Accurate identification of every user and device
  - Easy on boarding provisioning and securing of all devices
  - Centralized context aware policy management to control user access whoever.
  - Wherever and from whatever device.

### **RECOMMENDATIONS:**

After detailed analysis of the site survey reports, below are the recommendations to address the wireless issues observed at company and improve user experience. It has been analysed and compared the existing with the Cisco Best practices for the design level issues.

The detailed RF assessment in the floor has been done and according to the inputs captured like (Interference, S/N ratio values data rates and MCS index values) it has been suggested industry best practiced RF solution like overlapping of signal among adjacent access points with minimum of -67dBm signal across the floor.

The recommendations are mentioned below for every issue individually.

**Issue No. 1:** AP locations are not appropriate.

**Good to have:** The AP's need to be placed properly based on the density of users, the area that needs to be covered and the application being used in the environment.

**Recommendation:** AP location needs to be customized to get optimal signal coverage with minimum interference.

**Issue No. 2:** Access points are placed on the tables and floors at few places

**Good to have:** All the access points need to be ceiling mounted at appropriate locations.

**Recommendation:** To get the optimal signal coverage and the efficient overlapping these should be properly fixed to the ceiling in appropriate locations.

**Issue No. 3:** High interference in 2.4 GHz band.

**Good to have:** Need to utilize 5GHz RF band to minimise the impact of no of users connecting to 2.4 GHz band across the floors.

**Recommendation:** Replace all the old access point with 3702I which will support 4x4 MIMO and 3 spatial streams advanced RF band with high throughputs and bandwidth.

**Issue No. 4:** No Dual band MIMO & Clean Air Supported access points across the floors.

**Good to have:** Dual band supported and clean Air technology enabled access point need to be placed.

**Recommendation:** Recommendation to replace the existing access points 1142 access points with clean Air enabled 3702I access points to maintain the same features set across the floor.

**Issue No. 5:** No Signal overlapping.

**Good to have:** Signal must be covered with minimum 20% of overlap.

**Recommendation:** Dual band supported access point in appropriate places need to be placed to get extensive overlap among the side by side access points.

**Issue No. 6:** Unnecessary wireless propagation in the floors

**Good to have:** Disabling of printer wireless cards and connecting them in wired if possible.

**Recommendation:** Disable of Printers wireless cards and restricting the users to not to switch on any hotspots in the production environment.

**Issue No. 7:** AP Features mismatch.

**Good to have:** Same model of access points with high feature set need to be placed.

**Recommendation:** Existing EOL 1142 access points need to be placed with high feature enabled access points to avoid features mismatch and to get efficient roaming handoff among the access points and throughputs for the applications.

**Issue No. 8:** No Stateful Switch over

**Good to have:** at least four ports need to be connected from controller with LAG.

**Recommendation:** HA controllers with AP SSO need to be placed to get stateful failover, (Existing 5508 controllers need to be operated in HA mode).

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