



White Paper

Wireless Network Considerations for Mobile Collaboration

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I. Introduction

"My wireless network works great when I surf with my laptop – will it support streaming voice and video?" – D. Martens

When implementing a wireless LAN for voice and video it is important to understand the capabilities and limitations that are present in this technology. The demands of video can be supported however the implementation must be carefully planned and executed to ensure the desired performance level is achieved.

Wireless networks are widely used today, and although they may provide acceptable performance to users running business transactions or surfing the web, they may not be adequate for streaming video. Voice and video represent a continuous data stream and can exhibit noticeable visual or audible artifacts when losses or delays in data delivery are as short as a few hundred milliseconds. Guaranteeing low loss and delay is difficult given that the basis of WLAN is radio, a medium inherently susceptible to effects such as dropout, fade and interference. But engineers have evolved wireless LAN technology to make it robust and able to support reliable communications at rates of up to 54 Mbps, with even higher rates currently being developed.

To realize the full promise of this technology it must be used within the limits it was designed for, especially if the payload is voice and video. By following guidelines aimed at improving and optimizing the radio environment you can maximize range and performance, and achieve the best possible use of the wireless infrastructure.

The factors and processes which allow you to do this are discussed in this paper, namely:

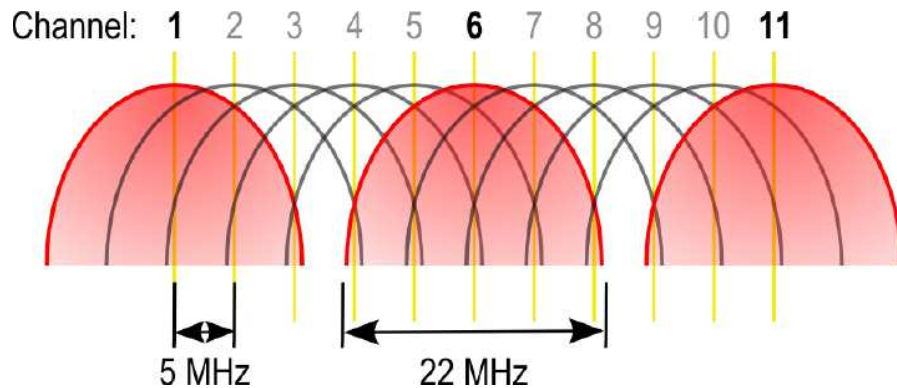
- Channel selection
- Interference
- Ensuring coverage
- Quality of Service
- Site Survey

Although Wireless Security is outside the scope of this paper, the additional overhead of encryption and authentication may have some effect on performance, especially at higher traffic and call volumes. Consult your wireless equipment vendor for more information.

II. Wireless Considerations

Channel Selection

The 802.11b and g WLANs are allowed to operate in a frequency band of 2.4 – 2.5 GHz. The band is split into channels as shown below – 11 in North America and 13 in most other countries.



The channels overlap, so that simultaneous use of nearby channels will interfere with each other. If the channels are used intermittently then this interference will be infrequent. With streaming voice and video however, this occurs on a continuous basis, resulting in diminishment in range and performance. To avoid this it is recommended that a site use widely separated channels, specifically: 1, 6, 11.

Interference

The 2.4 GHz band is shared by a number of products today. Although they are regulated to an extent, it is still possible and legal to have them operating side by side and affecting each other. In the case of WLANs, the presence of interference sources can strongly affect transmission errors and signal range. Thus it is important to identify such sources at the start and attempt to avoid or eliminate them as much as possible. However they can be a challenge to locate if they are intermittent. This is one of the goals of a site survey, discussed later.

Some common sources of interference in this frequency band include:

- microwave oven
- bluetooth devices
- 2.4 GHz cordless phones
- other 802.11 b/g networks (either your own or your neighbours)
- older pre-802.11 networks operating at 2.4 GHz

Interference can cause varying degrees of packet loss, and manifest as voice breakup or video distortion and frame loss. In extreme cases it can prevent a connection from starting or cause a connection to be lost.

Coverage

Coverage refers to the physical area or cell an access point can reliably maintain communications over. Areas without obstructions may achieve operation over many 100's of feet, although achievable data rate diminishes with signal strength and distance. The distance can be affected by:

- walls/windows between the access point and device which diminish the signal
- radio reflective materials – e.g. metallic, which cause reflected signals that interfere with the primary signal
- mounting location – a central location with line of sight between access point and devices is generally preferred, such as ceiling mount
- type of antenna, i.e. gain and directionality
- presence of noise sources can obscure signal, especially in fringe areas

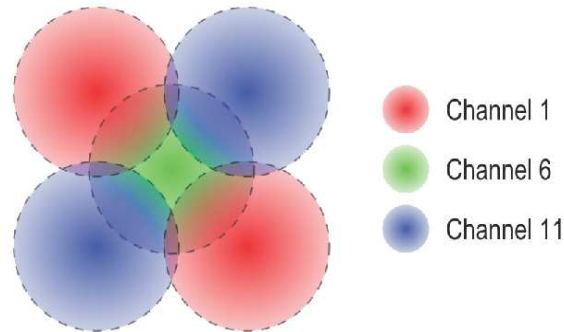
In some circumstances a directional antenna can be used to advantage if a specific area needs to be covered. Various antenna coverage patterns are available which concentrate the antenna power and sensitivity to achieve extended range and reject noise sources from side areas.

Sites demanding quality video performance will mandate a smaller cell size than conventional data-only deployments. The intent is to create a cell which offers sufficient coverage over its area to sustain traffic with minimum degradation. For example, a common industry rule of thumb for cell size is 5000 sq ft for a data network, versus 3000 sq ft for a network which needs to support video.

Covering Large Areas

By deploying multiple access points the coverage area can be enlarged as shown below. Wireless devices 'roam' between cells to maintain a data connection when the device is moved. For best performance adjacent cells should be on different channels, and only overlap at the fringe of their coverage area. Careful design of cells and placement of

access points is needed to avoid interference due to over crowding, and dead zones due to sparse layout. It is also important for the mobile equipment to be able to promptly and reliably roam to maintain a continuous connection for a video/voice stream and avoid packet loss during the roam operation.



Determining the access point layout and operating parameters is one of the tasks of the Site Survey. One strategy which is used to further improve performance is the design of physically smaller cells. This limits the number of devices covered by the cell and limits the traffic volumes in the cell, effectively resulting in less contention for airtime.

It is also important to note that although it is possible to operate a mixed 802.11 b/g WLAN so that a mixed community of b and g devices can be supported, the g devices will not be able to achieve their full throughput potential due to the periodic need to operate at the slower b speeds. For best performance it is recommended that 802.11g WLANs not be shared with b devices.

Quality of Service

Early wireless systems treated all participants as equals - an email message and a video stream had equal priority. Newer wireless equipment, particularly in the enterprise market, offer quality of service features which allow traffic to be prioritized so that delay sensitive traffic such as video is not delayed by other traffic. This is particularly important on mixed use networks that have various types of traffic present.

Vendors of enterprise-level wireless equipment offer QoS features today.

Site Survey

A site survey is performed to ensure that an existing or new WLAN infrastructure will provide adequate coverage and performance. This involves evaluation throughout the coverage area of factors such as:

- signal quality
- interference/noise
- channel assignment
- device location
- site topology

Part of this work can be handled using RF site survey tools provided by the WLAN vendors or from companies like AirMagnet or Ekahau. These tools automate and speed up the gathering and mapping of signal and noise measurements over the site to allow an accurate picture of the wireless environment to be determined.

It is best to use an experienced WLAN site survey contractor for complex installations. This is also usually available as a service from enterprise WLAN infrastructure suppliers.

III. Checklist

This section presents a checklist of items to consider when implementing a wireless LAN for voice and video.

- For maximum performance set access point and mobile devices to 802.11g-only mode.
- Avoid channel overlap: use channels 1, 6, and 11 only.
- Specify multimedia prioritization (QoS).
- Identify possible sources of interference.
- Perform a site survey.
- Ensure desired area has adequate coverage.
- Create more cells with less power to help ensure a device gets adequate bandwidth in high density areas.
- Increase range by utilizing a directional antenna.
- Consider a 'thin' architecture for large installations. A conventional access point contains functions such as data security, traffic management, configuration and others. By concentrating some of these functions in a centralized intelligent controller, a simplified or 'thin' access point can be deployed, leading to cost and management advantages.
- Examine product specifications carefully. Low cost consumer grade wireless equipment may not provide the high performance or QoS required by video streaming nor support the throughput demands of multiple users.

IV. Onsight™: Librestream's Mobile Video Collaboration System



The Onsight Mobile Collaboration System has been designed to stream voice and video over wireless networks. It will deliver optimum performance if careful attention is paid to the guidelines provided in this document.

The Mobile Collaboration Device features:

- 802.11b and g support
- Security – WEP, TKIP, 802.1x, WPA, WPA2 with AES
- Fast roaming – rapid detection and association with nearby access point when roaming from cell to cell
- High WLAN throughput – designed for high packet rate voice and video
- Local recording and deferred video collaboration
- Superb quality and reliability

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