

Student Housing Internet Delivery Design Best Practice: WiFi Coverage

For Student Housing residents, ubiquitous WiFi access is an essential part of their lives. It's critical that Student Housing owners and operators provide a reliable, worry free service to their residents, and getting their WiFi coverage right is a great first step.

By Andrew Marshall, Campus Technologies Inc, April 2016

How to successfully deploy WiFi is not something Student Housing owners and operators tend to get directly involved with very often; most (understandably) leave it to their technology providers.

However, understanding the key components of WiFi deployment success can definitely help owners and operators make informed choices when selecting a partner to install, upgrade or operate a student housing WiFi system.






Broadly speaking, the key factors to Student Housing WiFi success are *coverage* (how much usable wireless signal is available, and where); *density* (how many resident devices are served by a single wireless Access Point, or 'AP'); and *manageability* (making sure that the whole property WiFi system acts as a single, coordinated system and not just a sea of unmanaged islands of WiFi)

In this paper we are going to tackle the first aspect, coverage, and particularly SNR or signal to Noise Ratio.

Coverage

The overall coverage objective for Student Housing WiFi systems is to have a usable WiFi signal anywhere on the property that residents will go. That seems self-evident, but the key here is 'usable'.

Both a wireless AP and any client that uses them, such as a laptop, a tablet or a phone, contain both a radio transmitter and a radio receiver. To achieve a two-way internet connection, the AP transmits a wireless signal, and the client receives it, and correspondingly the client must transmit and the AP receive. The strength of the radio signal and how well the other end can receive it directly corresponds to how fast a connection is, and what throughput can be

	> 40dB SNR	Excellent signal (5 bars); always associated; lightning fast
	25dB to 40dB SNR	Very good signal (3 - 4 bars); always associated; very fast
	15dB to 25dB SNR	Low signal (2 bars); always associated; usually fast
	10dB - 15dB SNR	Very low signal (1 bar); mostly associated; mostly slow
	5dB to 10dB SNR	No signal; not associated; no go

achieved – and correspondingly how happy the resident will be.

So – how strong the wireless WiFi signal is determines how good the WiFi connection is, right? Unfortunately not.

The quality of a WiFi connection depends on two factors: the signal strength, and the ‘noise’ or interference level. We normally refer to the two together as the Signal to Noise Ratio, or SNR.

What is Noise?

Noise is interference. Think of it like this: if you’re standing on the main concourse of a railroad station, talking to somebody ten

feet away, it would be relatively easy to hear them at 3 am when everything is quiet. At 8 am in the morning rush hour, with many people making noise, announcements and trains coming and going it could be difficult to hear your conversation partner.

The WiFi signal level, minus the noise level, is the amount of signal that you can actually use to transport information, and this usable signal is measured and referred to as the SNR¹ or Signal to Noise ratio. The more noise you have, the less usable signal you have.

¹ Confusingly, WiFi SNR is not a ratio, it’s Signal minus noise.

SNR is expressed in dB², which is hard to visualize unless you're used to it.

Consequently manufacturers of end-user client devices such as smart phones use a 'bar' system instead, with one bar being slow/weak and five bars being fast/strong.

In an ideal WiFi world we want everyone to have 4 or 5 bars. At all costs, we don't want any areas with lower than 2 bars (15dB SNR)

Where does noise come from?

Noise mainly comes from devices operating on the same radio frequency³ as WiFi, although there is always some background noise just from the world around us.

If we have too much noise while we're trying to operate our WiFi system, it will become slow or unreliable, or in extreme cases will become unusable.

The worst culprits for introducing noise into Student Housing WiFi networks are residents who bring in their own WiFi equipment and connect it. This can be routers, access points or any device that gives out a strong WiFi signal. It's really important that your WiFi management system can identify these sources of noise so that you can eliminate them.

There are many other electronic devices that operate in the same frequency as WiFi, and these can also cause noise.

How do I know if I have a noise problem that's making my SNR too low?

There are two main ways (other than the undesirable one of waiting for your residents to complain)

Firstly, your WiFi management system that orchestrates all your AP's should be able to track and identify WiFi client SNR and report on it, and also identify interfering devices.

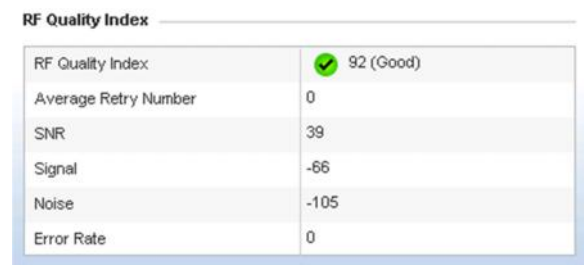


Figure 1: WiFi client SNR reported by a Zebra WiFi management platform. In this example(39dB SNR) the client would be receiving a solid 4 bars of usable signal.

MAC Address	Channel	SSID	First Seen	Top Reporter Username	Vendor	View	RSS	Is Interfering	Is Report	Termination Action
08:00:27:00:00:01	11	DIRECT-gp-BPA10A	29/09/2016	Ap0101	1901100(Passover)	NA	-82 dBm	✓	✗	✗
08:00:27:00:00:04	11		30/09/2016 15:01	Ap0101	Apple Inc.	NA	-59 dBm	✓	✗	✗
08:00:27:00:00:08	11	DIRECT-A2-FireTV_57	30/09/2016 21:14	Ap0101	88:0E:4D	NA	-83 dBm	✓	✗	✗
08:00:27:00:00:08	11		18/10/16	Ap0101	88:0E:4D	NA	-83 dBm	✓	✗	✗
08:00:27:00:00:0C	6	HP-Prod-DC-634-V-43	30/09/2016 20:14	Ap0101	Hewlett-Packard	NA	-84 dBm	✓	✗	✗
08:00:27:00:00:0E	11		30/09/2016 21:14	Ap0101	AC-SA-7A	20	-82 dBm	✓	✗	✗
08:00:27:00:00:0E	11		30/09/2016 21:14	Ap0101	AC-SA-7A	20	-82 dBm	✓	✗	✗
08:00:27:00:00:0E	11		30/09/2016 20:14	Ap0101	AC-SA-7A	20	-81 dBm	✓	✗	✗
08:00:27:00:00:0E	11	PSA-8798F-A100470	23/09/2016	Ap0101	Asustek Computer	20	-53 dBm	✓	✗	✗
08:00:27:00:00:0E	11		30/09/2016 21:14	Ap0101	88:0E:4D	20	-88 dBm	✓	✗	✗
08:00:27:00:00:0E	11	DIRECT-niku314	30/09/2016 21:14	Ap0101	88:0E:4D	20	-87 dBm	✓	✗	✗
08:00:27:00:00:0E	11		4/10/16	Ap0101	Link-On Tech	20	-51 dBm	✓	✗	✗
08:00:27:00:00:0E	6		30/09/2016 21:14	Ap0101	DE-AD-3C	20	-57 dBm	✓	✗	✗
08:00:27:00:00:0E	6	HP-Prod-A1-C00000	30/09/2016 21:14	Ap0101	Hewlett-Packard	NA	-83 dBm	✓	✗	✗
08:00:27:00:00:0E	11		30/09/2016 21:14	Ap0101	FA-8F-CA	NA	-87 dBm	✓	✗	✗
08:00:27:00:00:0E	11		30/09/2016 21:14	Ap0101	FA-8F-CA	NA	-87 dBm	✓	✗	✗

Figure 2: Interfering devices reported by a Zebra WiFi management platform

Secondly, you can and should have your property 'heat mapped' periodically. This process, usually conducted by your network partner, will give you a physical map of coverage that shows you the legitimate WiFi signal, the noise and the SNR right across your property so that you can take action to address problem areas if necessary.

² decibels

³ 2.4GHz and 5GHz

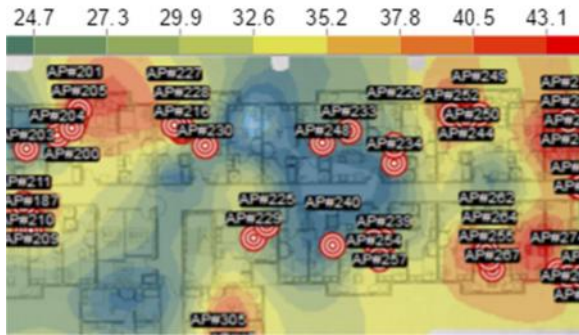


Figure 3: Sample part of an SNR heat map

Summary

Your property WiFi needs to provide a good enough SNR (among other things) for your residents to experience always on, always fast WiFi.

Your network partner can help you improve your residents WiFi experience by measuring and managing the sources of noise and interference at your property and taking remedial action, thus improving the SNR available to them.

If you have any questions about providing a great WiFi experience for Student Housing residents or the contents of this white paper, please contact us.

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Campus Technologies is a national vertically integrated managed network service provider designing, building and operating highly effective wired and wireless networks exclusively in student housing. See more at www.campustechnologies.com