

Wireless Research

Project: New Wireless Infrastructure

Department: ICT

Focus Area: Wireless

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Tester A: Carl Taylor (Network Manager)

Tester B: Brian Fensome (Site Agent, former ICT Tech)

Process: Research various Wireless providers and test equipment throughout the school to check for black spots, coverage, and throughput.

Testing Equipment: Old Dell D505 (from reserve pile), with external wireless card due to internal being broken. Approx age of all equipment – 4 years. Laptop is equipped with Windows XP, and to test the wireless signal, the program used was insider.

The test and report will follow the same format for all equipment to ensure impartiality and a fair test of the equipment and a standardized report. The report is put into its simplest form so that the governing body had an understanding of what has been done.

Confidential

Wireless Testing

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Equipment spec.

- Company: Meru
- Date: 08DEC2009
- Equipment: AP320: Dual 802.11n radio with 3x3 MIMO antenna array
- Estimated Coverage with 10 APs: 93% of whole school campus

The Meru equipment is uncomplicated however it uses unidirectional antenna array which means the signal strength may not be high in the predefined test areas. Also the fact that it is not centrally managed means setting up each individual AP, which took 10 minutes in this instance, however the power of the devices is phenomenal.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 90% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 67% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 32%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 2%. Due to the distance, and wall density, I was nothing short of amazed as was the site agent, as neither of us had seen a signal being broadcast at that distance considering the density.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had no signal, The field attained signal strength of 4% whilst roughly 250 yards from the AP.

Equipment spec.

- Company: Cisco
- Date: 14JAN2009
- Equipment: Cisco 4402 Wireless controller and 1x Cisco Aironet 1140 Access Point
- Estimated Coverage with 10 APs: 90% of whole school campus

The Cisco system has a well put together interface and installation was neither quick nor easy. However they made up for it in ease of use for the control interface after installation. It is also very powerful equipment, which is to be expected from Cisco who are market leaders in networking.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 89% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 76% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 48%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 9%. Due to the distance, and wall density, I was nothing short of amazed as was the site agent, as neither of us had seen a signal being broadcast at that distance considering the density.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 3% signal strength, The field attained signal strength of 1% whilst at the furthest point from the AP.

Equipment spec.

- **Company:** HP
- **Date:** 20JAN2009
- **Equipment:** HP Procurve Switches with wireless access points.
- **Estimated Coverage with 10 APs:** 64% of whole school campus

The HP Equipment is a bit odd as it is managed through the procurve switches rather than at a central point. Also each switch can only have 1 access point attached according to HP Technical Support.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 33% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 13% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 1%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 0%.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 0% signal strength, The field attained signal strength of 1% whilst at roughly 130ft from the AP.

Equipment spec.

- **Company:** Xirrus
- **Date:** 28JAN2009
- **Equipment:** Model XN16 Access point with Xirrus Management software.
- **Estimated Coverage with 10 APs:** 84% of whole school campus

The Xirrus equipment is moderately powerful equipment compared to we have seen in our testing. We have managed to have 85 wireless devices connect to the access point and stream BBC iPlayer.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 98% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 79% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 21%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 9%.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 1% signal strength, The field attained signal strength of 1% whilst at roughly 310ft from the AP.

Equipment spec.

- **Company:** Aruba
- **Date:** 12FEB2009
- **Equipment:** Aruba 2400 Controller + 1x Aruba AP-65
- **Estimated Coverage with 10 APs:** 78% of whole school campus

The Aruba equipment is moderately powerful equipment compared to what we have seen in our testing. We have managed to have around 100 wireless devices connect to the access point and stream BBC iPlayer.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 98% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 79% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 24%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 2%. Due to the distance, and wall density, I was surprised a signal being broadcast at that distance considering the density of the walls.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 0% signal strength, The field attained signal strength of 1% whilst roughly 280ft from the AP.

Equipment spec.

- **Company:** DLink
- **Date:** 19FEB2009
- **Equipment:** WBR-1310
- **Estimated Coverage with 10 APs:** 26% of whole school campus

Poor standard. We were sent home access points, despite explaining our needs and what had to be tested.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 8% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 0% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 0%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 0%.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 0% signal strength, The field attained signal strength of 1% whilst roughly 90ft from the AP.

Equipment spec.

- **Company:** Ruckus
- **Date:** 23FEB2009
- **Equipment:** Zone Director 1000 + 1x 2942 access Point
- **Estimated Coverage with 10 APs:** 98% of whole school campus

The Ruckus equipment is so far the most powerful equipment we have seen in our testing. We have managed to have every wireless device (near 200) connect to the access point and stream BBC iPlayer.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 98% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 79% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 52%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 12%. Due to the distance, and wall density, I was nothing short of amazed as was the site agent, as neither of us had seen a signal being broadcast at that distance considering the density of the walls.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 9% signal strength, The field attained signal strength of 4% whilst at the furthest point from the AP.

Equipment spec.

- **Company:** Belkin
- **Date:** 03MAR2009
- **Equipment:** Belkin G Wireless Modem Router
- **Estimated Coverage with 10 APs:** 43% of whole school campus

Shockingly poor. We were sent standard home access points despite explaining what was needed and what was to be tested.

Access point was put in Science Prep Room (Has the most dense walls and according to blueprints, also has the most steel mesh in the walls as each surrounding wall is a supporting wall).

We checked in the Science Lab 2 (adjoining to the prep room) and Signal strength is 28% at the furthest point from the prep room (roughly 30ft).

We checked in the Learning Workshop (roughly 40ft from the access point) and signal strength was reduced to 7% - it is our belief this is because of the signal going through 2 steel meshed lined concrete walls and distance from the AP.

We checked in the Sanctuary (roughly 100ft away) and signal strength was at 0%. Again we believe the signal strength and wall density is the key factor.

We tried in the Music Room (roughly 150ft away) and signal strength was 0%.

We moved the access point to the ICT Office and tested the strength across the school field and the site agents' house (roughly 300 ft away) which had a 0% signal strength, The field attained signal strength of 1% whilst roughly 100ft away from the AP.

Project Highlights

Brian and I worked out that the transfer rate for each brand by transferring a 300mb folder from 1 laptop to another via the wireless systems as supplied by each company. The details are as follows:

Ruckus: Average transfer rate of 8.2mb per second
Meru: Average transfer rate of 6.9mb per second
Cisco: Average transfer rate of 6.7mb per second
Xirrus: Average transfer rate of 5.9mb per second
Aruba: Average transfer rate of 5.6mb per second
HP: Average transfer rate of 4.9mb per second
Belkin: Average transfer rate of 2.9mb per second
DLink: Average transfer rate of 2.8mb per second

We also tried to connect every wireless device to the access points supplied and stream BBC iPlayer, the results of how we got on are below:

Ruckus: 217 wireless devices connected, 196 streaming BBC iPlayer
Meru: 217 wireless devices connected, 163 streaming BBC iPlayer
Cisco: 217 wireless devices connected, 142 streaming BBC iPlayer
Xirrus: 85 wireless devices connected, 71 streaming BBC iPlayer
Aruba: 96 wireless devices connected, 84 streaming BBC iPlayer
HP: 45 wireless devices connected, 38 streaming BBC iPlayer
Belkin: 27 wireless devices connected, 19 streaming BBC iPlayer
DLink: 25 wireless devices connected, 16 streaming BBC iPlayer

We then tried to do video conferencing with 30 devices, and this is how they fared:

Ruckus: 30 wireless devices connected, 6 sets of 5 wireless devices active in video conference
Meru: 30 wireless devices connected, 6 sets of 5 wireless devices active in video conference
Cisco: 30 wireless devices connected, 6 sets of 5 wireless devices active in video conference
Xirrus: 30 wireless devices connected, 5 sets of 5 wireless devices active in video conference
Aruba: 30 wireless devices connected, 4 sets of 5 wireless devices active in video conference
HP: 30 wireless devices connected, 4 sets of 5 wireless devices active in video conference
Belkin: 30 wireless devices connected, 2 sets of 5 wireless devices active in video conference
DLink: 30 wireless devices connected, 1 sets of 5 wireless devices active in video conference

I have broken my report down into my top 3, notable successes and project shortcomings.

Top 3

Brand	Factors That Supported Success
Ruckus	Powerful access points, easy to use management console.
Meru	Powerful access points, good signal strength and range
Cisco	Market leader in networking technology and they have powerful access points.

Other Notable Project Successes

Brand	Factors That Supported Success
Xirrus	The fact that it did as it said it would was a good testament to it as a product, however under our scrutiny it did not stand up to the same standard as Ruckus, Meru or Cisco.

Project Shortcomings

Project Shortcoming	Factors That Supported This
Aruba	Failed to do as specified. When speaking to the company after the test they said that the signal dissipates badly when it comes in contact with a meshed wall (which I did we had state before testing).
HP	Access points had to be managed by the switches, and each switch could only have 1 Access point attached according to HP Tech Support. This would cost a fortune for us when it comes to buying the equipment as procurve switches are £300+
Belkin	Failed to listen to what was needed.
DLink	Failed to listen to what was needed.

After careful thought and discussions with the ICT Co-Ordinator, we have decided that the Ruckus kit is the kit we would like to purchase. On all tests it came top of the scoreboard, and provided us with the best solution. We would also be dropping our access point usage from 37 standard access points to 10 high power Ruckus AP's which offer better coverage, range, throughput and value for money.

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