TIME WARNER CABLE ARENA

Arena Infrastructure Deployment Tailored to Support High Density of Wi-Fi

CASE STUDY

OVERVIEW

Located in Charlotte, North Carolina, the Time Warner Cable (TWC) Arena is the 19,000 seat home to the Charlotte Bobcats of the NBA. It is also used for a variety of other events including concerts, ice shows, other types of sporting events and the 2012 Democratic National Convention.

REQUIREMENTS

- Complete coverage across all parts of the arena, including public seating areas, luxury suites, concourses, locker rooms, press boxes and more
- Provide enough capacity to allow 12% of the 19,000 person crowd to simultaneously achieve 400 kbps of sustained throughput (912 Mbps total capacity in the bowl)
- Majority of the capacity had to be delivered in the 2.4 GHz band, with the 5 GHz band available for future growth
- Highly reliable deployment to support high-profile events like the Democratic National Convention

SOLUTION

- 127 AP's deployed across all parts of the arena
- 22 Ruckus ZoneFlex 7762 AP's with narrow beam internal antennas mounted in the catwalks high above the main seating area
- Additional Ruckus ZoneFlex 7762-S AP's with internal 120° sectorized antennas mounted in the catacombs under the seats in the lower levels of the arena
- Ruckus ChannelFly™ technology was used to greatly increase capacity and lower interference

BEST PRACTICES

- Take advantage of the structure whenever possible to shield AP's from each other
- Always deploy dual-band AP's as 5 GHz is really well suited to high-density environments
- Use advanced antenna technologies to focus RF energy and limit interference
- Use technologies like ChannelFly to optimize the selection of RF channels to limit interference and increase capacity

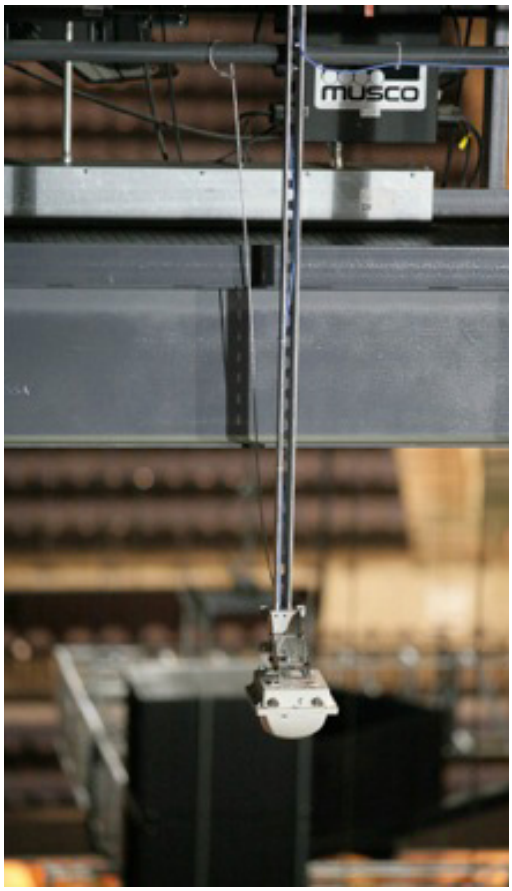
BRINGING WIRELESS BROADBAND TO THE TIME WARNER CABLE ARENA

In the fall of 2011, Ruckus Wireless began to work on the design of a new Wi-Fi network for the Time Warner Cable Arena in Charlotte, North Carolina. The network would be replacing an older network put in by Aruba Networks. TWC was looking for a new solution that would provide greatly enhanced performance and capacity across all the public seating areas in the 19,000 seat arena as well as in the locker rooms, luxury suites, concourses, and back office areas in the facility. The TWC Arena is used for a variety of purposes in addition to being the home of the Charlotte Bobcats of the NBA. This list includes concerts, ice shows, other types of sporting events, and of course the 2012 Democratic National Convention that ran from September 4th-6th.

Deploying wireless broadband connectivity in a high-density venue like the TWC Arena is very challenging undertaking. Especially since we now live in a time when almost everyone is carrying a smartphone of some sort and they all expect to be able to connect to the Internet from almost any location. There may also be tablets and laptops, depending on the event. Ruckus and TWC started out by taking a fresh look at the opportunity. The first step in a project like this is to get a reasonably accurate assessment of the demand that 19,000 people can place on the network. A series of assumptions were made regarding the percentage of attendees that would carry a smartphone into the venue, the percentage that would be online at any point in time, and how much bandwidth they'd require. This led to the network being designed to support 12% of the crowd being online at any point in time, and each online user could achieve a throughput of 400 kbps sustained. This required a total network capacity of 912 Mbps in the main seating area in the bowl. Actual peak uploads and downloads were rate limited to 12 Mbps.

For all other locations in the arena (locker rooms, concourses, back offices, luxury suites, etc.) the need was more for coverage, as we wanted to make sure that the network could be accessed from anywhere. This led to two very different design approaches, one optimized for capacity and the other for coverage.

The greatest design challenge came in addressing the enormous capacity requirements in the main seating areas in the arena bowl. The usual approach to supporting high-density environments is to deploy a very large number of APs, but this can often be counter-productive. A large number of AP's will in theory provide the necessary capacity, but their propensity to interfere with one and other can do just the opposite. High-density deployments are all about interference management. For all the other areas the design challenges were much more straightforward as we were just after coverage. In the final design we were able to cover all parts of the arena with 127 Ruckus Access Points.



Ruckus 7762 mounted in the catwalks high above the TWC Arena floor.

Ruckus was selected for the TWC Arena project specifically because its technology is well suited to the challenges associated with a venue that requires coverage and very-high capacity. ARRIS Professional Services was selected to do the actual install. The following case study describes the design approach that Ruckus used in a bit more detail.

DUAL-BAND APS

High-density deployments should always be based on dual-band carrier-class 802.11n access point technology. Dual-band refers to the ability to operate in the 2.4 GHz and 5 GHz RF bands simultaneously. The former is the most commonly used band for Wi-Fi deployments, as it is supported on all Wi-Fi enabled devices. The latter is now starting to make its way onto more and more mobile devices and it has numerous advantages that make it well suited to a project like this including access to over 500 MHz of available spectrum, and in a high-density deployment you can never have enough spectrum. High frequency bands like 5 GHz also don't propagate as well as the lower frequency bands, which is actually a good thing in a high-density deployment as it helps to limit co-channel interference. Ruckus provides Band Steering technology that can force dual-band laptops, tablets, and smartphones onto the 5 GHz band where there is much greater capacity.

Most laptops and tablets are already dual-band enabled, and by the end of this year the industry will begin to ship large numbers of dual-band smartphones. Of special note here, was Apple's recent announcement that the iPhone 5 would be dual-band enabled. Our target for the TWC Arena design was to deliver the needed network capacity using mainly the 2.4 GHz band. The fact that all APs are dual-band, gives TWC a tremendous amount of headroom as more dual-band smartphones begin to rollout.

THE RIGHT ANTENNA TECHNOLOGY

To get adequate coverage over the main seating area, APs were mounted on the catwalks that sat high above the arena floor. These catwalks support lighting, audio, and other equipment necessary to support arena events. A total of 22 Ruckus 7762 APs were used at this location. To optimize coverage while at the same time minimizing interference, these APs were all equipped with internally mounted sectorized antennas. These antennas direct all RF energy in a specific direction, and in this case it was down into specific seating areas. Given the height of the catwalk above the floor, the narrower the beam the better. For other parts of the arena (luxury suites, locker rooms, concourses, back offices, etc.), Ruckus 7363 omni-directional APs were used. These AP's utilized BeamFlex™ adaptive antenna technology to keep RF energy focused on the specific users for whom the transmissions are intended and away from other APs that might see this as interference. In the 2.4 GHz band there are 3 non-overlapping 20 MHz channels and in the 5 Ghz band there are 23 non-overlapping 20 MHz channels. Channelfly, a Ruckus proprietary technology, was used on this project to allow APs to automatically select the right RF channel based on the conditions. This approach can increase capacity while at the same time minimizing interference. In the TWC Arena project, Channelfly was shown to increase available capacity in the 2.4 GHz band by over 56% as compared to traditional static channel selection algorithms.

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AP PLACEMENT

A design goal for the TWC Arena was to make sure that all seating areas were able to get a very strong signal. This included fans down on the floor as well as those in the highest levels in the arena. Because the first group of AP's was mounted in the catwalk, they tended to provide a stronger signal for those fans at the higher levels in the arena. To strengthen the signal for fans down near the floor, AP's were mounted in the catacombs under the seats. This provided a very good signal for the fans sitting above, and the concrete kept the RF energy from propagating too far. This allows a large number of APs to be deployed down near the floor, without creating much of a co-channel interference problem. Ruckus 7762 APs with 120º sectorized antennas were used to focus a very narrow beam of RF energy up toward fans sitting directing above each section of the catacombs. The concrete structure allowed this deployment model to be reproduced for each section, as it tended to absorb RF energy and limit co-channel interference.

CONCLUSIONS

The challenge in deploying wireless broadband in a high-density venue like the TWC Arena is in managing interference. A key design criteria is to always mount APs, to the extent possible, in an area where RF energy can only propagate out in the intended direction. BeamFlex adaptive antenna technology has proven to be of great value when coupled with proper site selection.

The next step for the Time Warner Cable Arena is to start looking at compelling new applications that can be enabled over this broadband infrastructure. This includes the option to advertise special services to fans by way of this wireless broadband network. These services could include information on where to buy various food items, or merchandise, or even tickets to a future event, all of which can be handled on-line with a smartphone. Sporting venues all over the world are moving rapidly toward wireless broadband as a way to provide new services to the large crowds that visit their facilities every day. The TWC Arena in Charlotte is well out in front of this trend with a cutting edge Smart Wi-Fi network from Ruckus Wireless.

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