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By Metin Ismail Taskin, CTO at AirTies

Service providers struggled for years to make high-quality, reliable wireless video streaming a reality. They often confronted pervasive problems that seemed impossible to resolve. Lately technical developments have made it possible to overcome problems commonly associated with wireless video distribution, particularly coverage area, packet loss, interference, quality of service, jitter and latency. Recently, it seems that wireless video streaming has finally come of age.



Metin Taskin

Almost every wireless solution that came out in the past, worked in environments where the transmitter and receivers were in close proximity and there was no wireless interference. When these conditions were not met, the video delivery was very poor, resulting in freezes and pixilation.

The use of reinforced concrete and brick, particularly in older buildings, has posed the biggest obstacle to wireless streaming. The walls and floors severely weaken the wireless signals and also create a phenomenon called multipath while signals are passing through or reflected by them. Both weak signals and strong multipath results in packet loss and lowers data rate. However, the development of new technology called MIMO (Multiple Input Multiple Output), which incorporates multiple transmitters and receivers in the same device, successfully overcomes this hurdle by increasing tolerance against signal attenuation and multipath. Moreover, growing popularity of using 5 GHz bands with many available frequency channels to increase the network capacity and avoid interference has revolutionised wireless streaming. Today dynamic channel management technology scans the available streaming channels for interference, traffic and noise. It then automatically selects the optimal channel with least interference to deliver multi-HD video streams. There are also new standards that ensure Quality of Service to high-priority video packets against low-priority data packets.

Technological developments aside, what are the practical developments of this technology and how can the average consumer benefit from these developments and enjoy reliable, wireless video streaming?

A Retrospective: Then and Now

For many years, the ability to stream IP video inside a home was a goal pursued by a variety of players. Several vendors developed a number of proprietary solutions. Despite some incremental industry technological advancements, no universal solution to the challenge of complete wireless streaming was realised until recently.

The IEEE, one of the world's largest professional organisations specialising in the advancement of technology, has developed many wireless LAN (local area network) standards for solutions and products to adhere to over recent years, each with varying levels of success and failures.

When we started with 11Mbps 802.11b devices, it quickly became apparent that video delivery over Wi-Fi networks was hindered by a low data rate, high packet loss and poor quality of service. We were then reassured with a new, faster standard (54 Mbps) and 802.11a was introduced. However, even the 802.11a was limited: it only operated in 5GHz frequency band and 802.11b devices were interoperable with the 802.11a standard. Shortly after 802.11a, the next iteration was developed, the 802.11g standard and 802.11g was very successful for internet access and data delivery but it was not good enough to deliver video. It suffered from packet loss, interference and insufficient wireless range issues.

Today the common wireless LAN standard is 802.11n. Thus far, 802.11n has proven to be the most successful because it provides a framework for chipset developers when building support for video steaming. The 802.11n standard was the first that used MIMO and allowed up to four transmitters and four receivers (1x1 to 4x4) to run simultaneously to increase the wireless data rate up to 600 Mbps. MIMO technology not only increases the data rate to 600 Mbps, it also increases wireless coverage range by using multiple antennas to transmit and receive.

Due to the higher costs of having multi-transmitter and receiver circuits when the 802.11n standard came into force, Wi-Fi chipset companies did not implement more than two transmitters and two receivers. One company, Quantenna, focused efforts on developing a unique chipset with 4x4 MIMO. With this technology wireless devices could reach a data rate of 600 Mbps while increasing the coverage range. Practically speaking, Quantenna chips make it possible to stream multiple HD video channels simultaneously and cover an unprecedentedly wide wireless range.

Bridging the Gap

In the absence of a truly effective Wi-Fi solution for wireless video streaming an alternative, known as Power Line Communication Technology, was employed. Power line communication systems carry data on the same wires as those for electric power. Consumers can buy power line adapter sets at most electronics retailers and use them to establish a wired connection using existing electrical wiring in the home.

Today power line adaptors only deliver one or two HD streams. Unfortunately, power line suffers from low quality wiring in homes and interference generated by other electronic devices using the same electric wires. Because of this, power line adaptors cannot deliver their advertised data rates in a real home environment. The realistic limit delivers 1-2 HD video streams at an acceptable quality.

The demand for video delivery capacity in a home network continues to increase as consumers expect more. The maths is simple: a high-quality HD video starts at 10 Mbps per channel and goes up to 20 Mbps, depending on the delivery network. When a home has three HDTVs with PVRs capable of recording multiple streams simultaneously, the number of HD video streams that need to travel inside the home easily increases to nine (three for each PVR: one watch, two record). Thus, whatever the delivery solution may be, it needs to have a network capacity between 90-180 Mbps. No power line adaptors can deliver that performance.

Looking Ahead: the Future of Wi-Fi

New standards and recent innovations in wireless networking have made the concept of the networked home a reality and seamless video streaming via a Wi-Fi network feasible. From my perspective, there are three essential components to make the experience of a wirelessly networked home truly compelling to the consumer: 1) a viable network capable of streaming multi HD video throughout the home, 2) the ease of installation and use, and 3) the integration of applications that will ignite consumer interest.

The new 4x4 MIMO chipset is capable of delivering the wireless performance we have all been waiting for at an affordable price. Industry leaders in Europe and America are currently testing this technology. Many regard 4x4 as the right solution, and many more are set to follow suit. Although 4x4 technology solves the problem of wireless range and signal quality, it is not panacea for the problems that inhibit reliable Wi-Fi streaming across a large area. There are still notable exceptions where 4x4 technology cannot cover large houses.

This is where innovative technology, such as AirTies' automatic mesh networking technology, complements industry standards to make wireless streaming reliable everywhere. Wireless mesh technology makes every TV with a connected wireless adapter a "mesh" point. Rather than simply receive signals from a central router, mesh points are smart: they route wireless packets to other devices to maximise the total network capacity and extend the wireless coverage area. Previously most wireless devices acted as clients and only received signals from a central router. In a large house, the client device may have a very weak reception from the central router resulting in a connection with very low data rate and high packet loss. A series of mesh points eliminates weak links and maximises the total network throughput while enabling endless wireless expansion across large area. For example, if there is a home with a wireless router and three TVs with wireless adaptors, the wireless coverage area effectively becomes four times wider than a single Access Point with three wireless clients as supported by any other product.

Mesh technology provides ultra-wide coverage and reliable wireless networking for entire home entertainment. It builds HD video streaming solutions with unmatched range and performance, whilst avoiding problems typically associated with wireless video distribution.

Conclusion

The home networking revolution has entered a new era in which users can easily and efficiently share video and data across many devices. The success of the smart phones, tablets and internet video delivery services like BBC iPlayer has ignited user demand for video based content and made the need for wireless video streaming ubiquitous. As many broadcast operators start to deploy whole home PVR solutions where only one central PVR records live content then streams it to other TVs in the home, the delivery of many high bitrate HD videos inside the home is a great need. The most convenient way to create a home network with the capacity to deliver video and data is with wireless video streaming technology. Yet for wireless video streaming to succeed, it will need to make sound commercial sense to operators. This means that wireless networking solutions need to be affordable whilst the cost of deployment and ownership are minimal. With affordable 4x4 802.11n wireless chips, the use of 5 GHz, new QoS and interference avoidance algorithms, and mesh networking technology, delivering multi-HD video streams becomes affordable and easy to use.

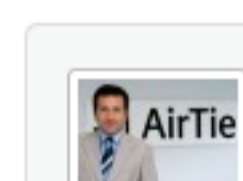
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About the Author

Metin Ismail Taskin is Chief Technology Officer at AirTies. He received his bachelor's degree in Electrical and Electronics Engineering and master's degree in Biomedical Engineering from Bogazici University (Bosphorus University) in Istanbul, Turkey. After working as a research engineer at TUBITAK (Scientific and Technical Research Council of Turkey) National Metrology Institute, Taskin continued his career in the United States. First, he worked at Hitite Microwave Corporation in Boston MA, designing radar and microwave communications systems. Later, he joined Cisco Systems in San Jose CA, and worked for Wireless Access Business Unit developing fixed wireless access devices. At this department, he was responsible for system design of outdoor wireless base station and subscriber devices providing wireless Internet access. Taskin then moved to the Wireless Networking Business Unit of Cisco and became a system architect. He led a team of 20 to 30 engineers who developed BR1410, an IEEE 802.11a compliant Wireless Outdoor Bridge. His success in the design and development of this product won him the "Cisco Innovator" award. Taskin left Cisco Systems and moved back to Turkey in order to join the founding team of AirTies. He is currently working as the company's Chief Technology Officer.

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