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Multicast Wifi Problem Statement
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Abstract

There have been known issues with IP Multicast, in an 802.11 environment, which have prevented the deployment of multicast in these wifi environments. The mboned working group would like to gather the problems of wifi multicast into one problem statement document so as to offer the community guidance on current limitations.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on January 7, 2016.

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1. Introduction

Multicast over wifi has been used to low levels of success, usually to a point of being so negative that multicast over wifi is not allowed. More applications, such as push to talk in hospitals, video in enterprises and lectures in Universities, are streaming over wifi. And many end devices are increasingly using wifi for their connectivity. To make make multicast over wifi work successfully they often need to modify the multicast to instead be sent as unicast in order for it to successfully transmit with useable quality. Multicast over wifi experiences high packet error rates, no acknowledgements, and low data rate. This draft reviews these problems found with multicast over wifi. While this is not a solutions draft, common workarounds to some of the problems will be listed, along with the impact of the workarounds.

2. Multicast over WiFi Problems

802.11 is a wireless broadcast medium which works well for unicast. With multicast, however, there are no ACKs for multicast packets so there can be a high level of packet error rate (PER) due to lack of retransmission and because the sender never backs off. It is not uncommon for there to be a packet loss rate of 5% which is particularly troublesome for video. Additionally, multicast is typically sent on a low date rate which makes video particularly troublesome. Wifi loses many more packets then wired due to collisions and signal loss. There are also problems because clients are unable to stay in sleep mode due to the multicast control packets continuing to unnecessarily wake up those clients and subsequently reduce energy savings. Video is becoming the dominant content for

end device applications, with multicast being the most natural method for applications to transmit video. Unfortunately, multicast, even though it is a very natural choice for video, incurs a large penalty over wifi.

One big difference between multicast over wired versus multicast over wired is that wired links are a fixed transmission rate. Wifi, on the other hand, has a transmission rate which varies over time depending upon the clients proximity to the AP. Throughput of video flows, and the capacity of the broader wifi network, will change and will impact the ability for QoS solutions to effectively reserve bandwidth and provide admission control.

The main problems associated with multicast over WiFi are as follows:

- Low Reliability
- Lower Data Rate
- High interference
- High Power Consumption

These points will be elaborated separately in the following subsections.

2.1. Low Reliability

Because of the lack of acknowledgement for packets from Access Point to the receivers, it is not possible for the Access Point to know whether or not a retransmission is needed. Even in the wired Internet, this characteristic commonly causes undesirably high error rates, contributing to the relatively slow uptake of multicast applications even though the protocols have been available for decades. The situation for wireless links is much worse, and is quite sensitive to the presence of background traffic.

2.2. Low Data Rate

For wireless stations associated with an Access Points, the necessary power for good reception can vary from station to station. For unicast, the goal is to minimize power requirements while maximizing the data rate to the destination. For multicast, the goal is simply to maximize the number of receivers that will correctly receive the multicast packet. For this purpose, generally the Access Point has to use a much lower data rate at a power level high enough for even the farthest station to receive the packet. Consequently, the data rate of a video stream, for instance, would be constrained by the

environmental considerations of the least reliable receiver associated with the Access Point.

2.3. High Interference

As mentioned in the previous subsection, multicast transmission to the stations associated to an Access Point typically proceeds at a much higher power level than is required for unicat to many of the receivers. High power levels directly contribute to stronger interference. The interference due to multicast may extend to effects inhibiting packet reception at more distant stations that might even be associated with other Access Points. Moreover, the use of lower data rates implies that the physical medium will be occupied for a longer time to transmit a packet than would be required at high data rates. Thus, the level of interference due to multicast will be not only higher, but longer in duration.

Depending on the choice of 802.11 technology, and the configured choice for the base data rate for multicast transmission from the Access Point, the amount of additional interference can range from a factor of ten, to a factor thousands for 802.11ac.

2.4. High Power Consumption

802.11 multicast is somewhat incompatible with radio sleep schedules. One of the characteristics of multicast transmission is that every station has to be configured to wake up to receive the multicast, even though the received packet may ultimately be discarded. This process has a relatively large impact on the power consumption by the multicast receiver station.

3. Common remedies to multicast over wifi problems

One common solution to the multicast over wifi problem is to convert the multicast traffic into unicast. This is often referred to as multicast to unicast (MC2UC). Converting the packets to unicast is beneficial because unicast packets are acknowledged and retransmitted as needed to prevent as much loss. The Access Points (AP) is also able to provide rate limiting as needed. The drawback with this approach is that the benefit of using multicast is defeated.

Using 802.11n helps provide a more reliable and higher level of signal-to-noise ratio in a wifi environment over which multicast packets can be sent. This can provide higher throughput and reliability.

4. IANA Considerations

None

5. Security Considerations

None

6. Acknowledgments

The following people have contributed information helpful for the development of this Internet Draft:

- Dave Taht
- Donald Eastlake
- Marc Mosko

7. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

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