Practical Analysis of IEEE 802.11ax Wireless Protocol in Wi-Fi Boosters Environments

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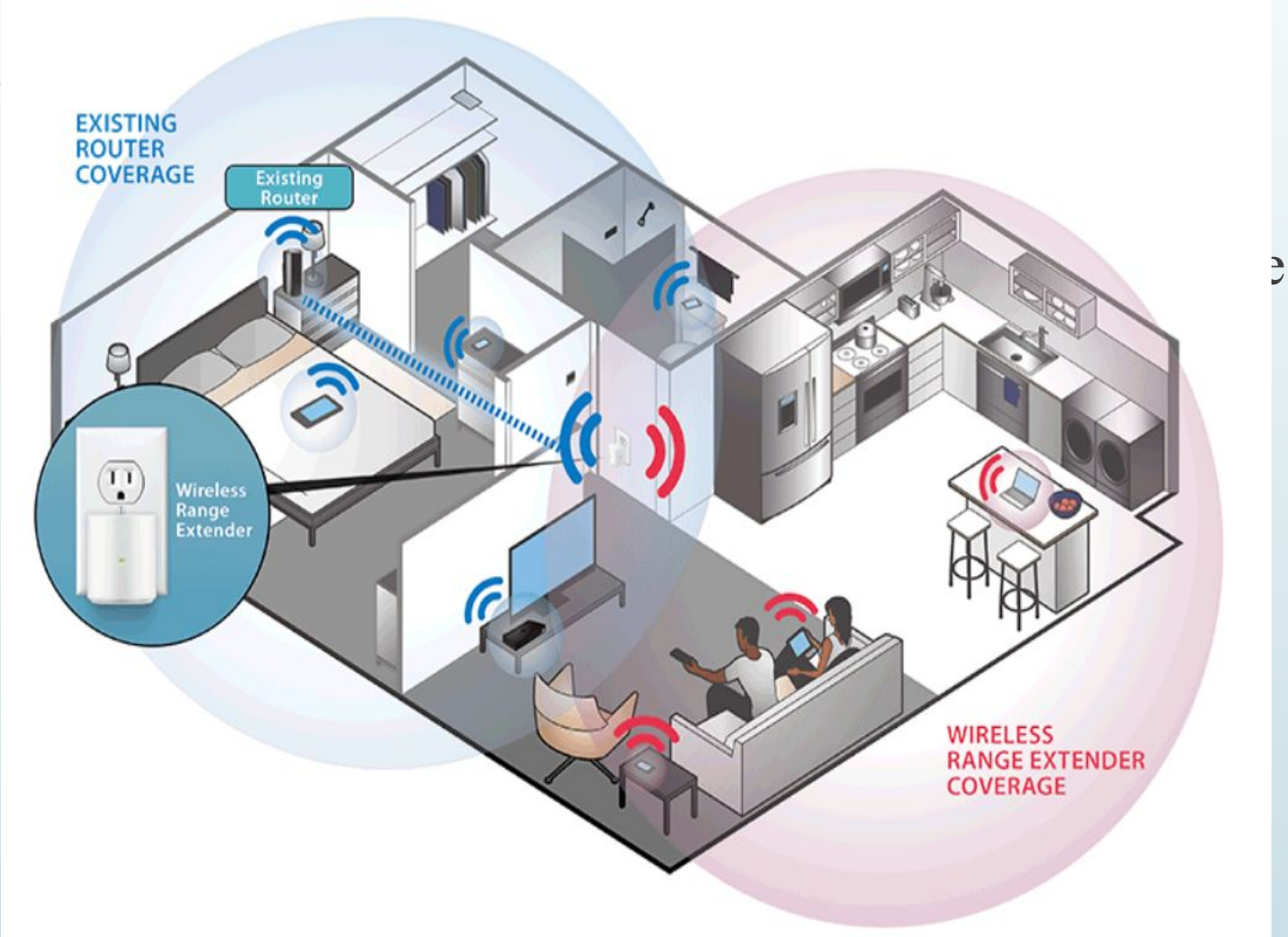
Abstract

- All the world now relies on networks to share information between users
- where different data types are transferred wirelessly from network to network.
- In this paper, a practical analysis was made of the latest IEEE 802.11ax wireless
- To compare with two types of Wi-Fi booster networks, Mesh and Extender Wi-Fi
- while measuring the throughput, delay, and signal strength metrics.
- The main importance of this paper is to give a more practical understanding and avoid the main problems of using the wireless protocol 802.11ax in different network types

Introduction

- When the WLAN signal is not performing at best due to dropped connections, slow speeds, dead Wi-Fi spots
- a solution must be done to enhance the network connection for the WLAN users with the best Wi-Fi wireless protocol
- The upgrades in IEEE wireless protocols of 802.11 made it possible to enhance mobility, quality, speed, coverage distance and more.
- These deployments can be used for Wi-Fi booster networks such as mesh and Wi-Fi extenders

Mesh


EXISTING
ROUTER
COVERAGE
Existing
Router
Wireless
Range
Extender
WIRELESS
RANGE EXTENDER
COVERAGE

Wi-Fi Extenders

- While in Wi-Fi extenders are devices that extend the Wi-Fi signal through different areas to help far devices connect to the main device

IEEE 802.11 Wireless Standards	Frequency	Maximum Data Rate
802.11a	5GHz	Mbps 54
802.11b	2.4GHz	Mbps 11
802.11g	2.4GHz	Mbps 54
802.11n	2.4GHz, 5GHz	Mbps 600
802.11ac	2.4GHz, 5GHz	Gbps 1.3
802.11ax	2.4GHz, 5GHz, 6GHz	Gbps 10-12

IEEE 802.11ax Wireless Protocol

- This wireless protocol is the enhanced version of the preview 802.11ac wireless protocol, with newer features that support scalability and flexibility with less power consumption for more traffic-demanding applications.
- The new IEEE 802.11ax gives a higher level of service to the new and old applications, making it desirable to use and replace the old IEEE 802.11 wireless protocols.
- The OFDMA technology in IEEE 802.11ax supports eight spatial streams and gives approximately 10-12 Gbps data rate at the physical layer. Therefore, all users will achieve higher data transmission at the MAC layer with the best user experience
- Also, with the support of dual-band frequencies of 2.4GHz and 5GHz, different devices can connect for a more extended range and faster data rate

Wi-Fi Boosters Networks

Practical Scenarios Analysis and Results

- To analyze the IEEE 802.11ax wireless protocol performance in real-life scenarios,
- two practical scenarios were designed and implemented, with wireless mesh and Wi-Fi exte

Parameters	Metrics
Video Format	4K H.264
Video resolutions	x 2160 3840 Pixel
Video Length	min 12
Frame Rate	FPS 60
Bit Rate	Mbps 91.20

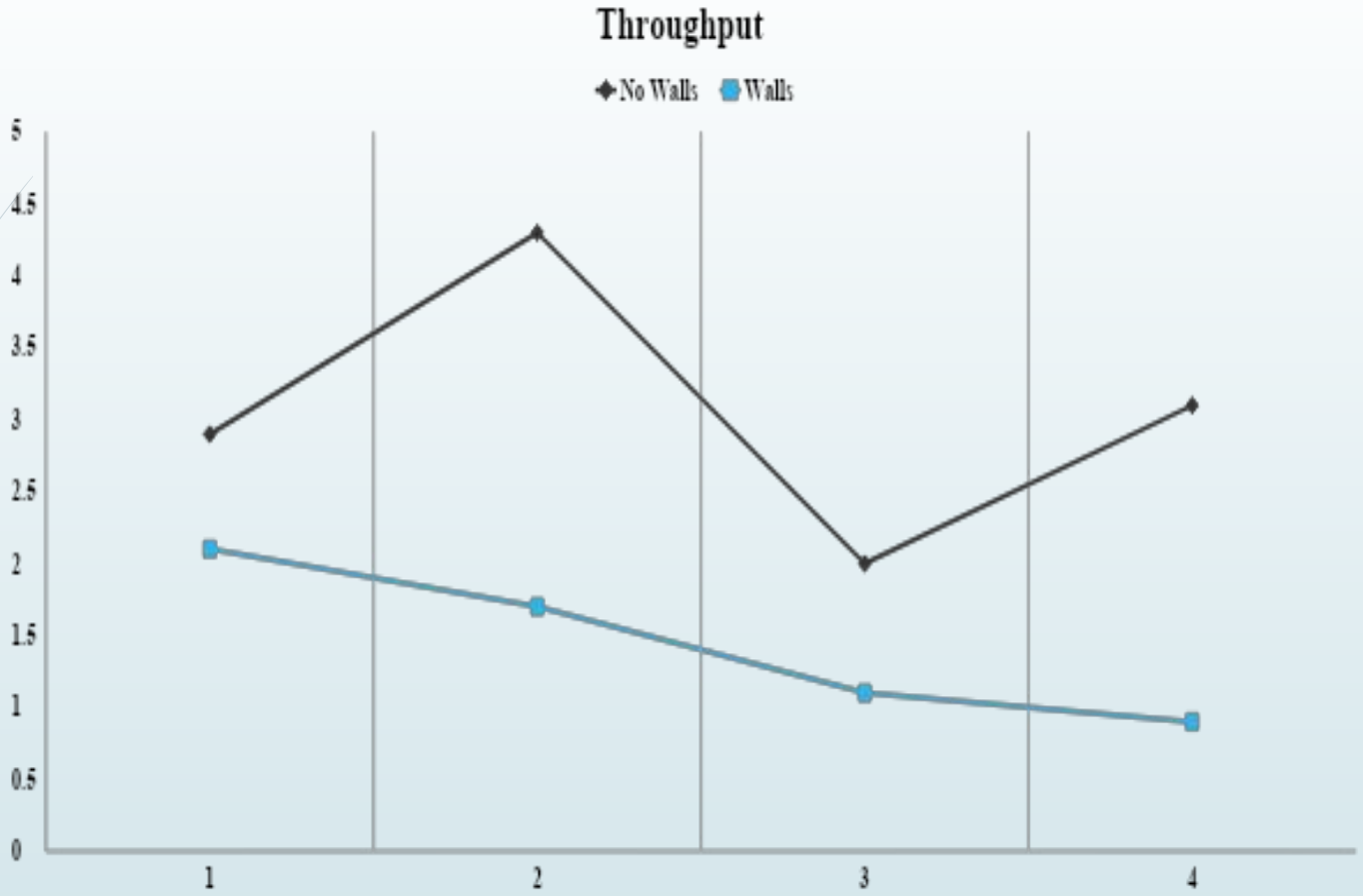


Figure (6): Throughput (Gbps) of Both Mesh and Extender network with and without walls

Introduction

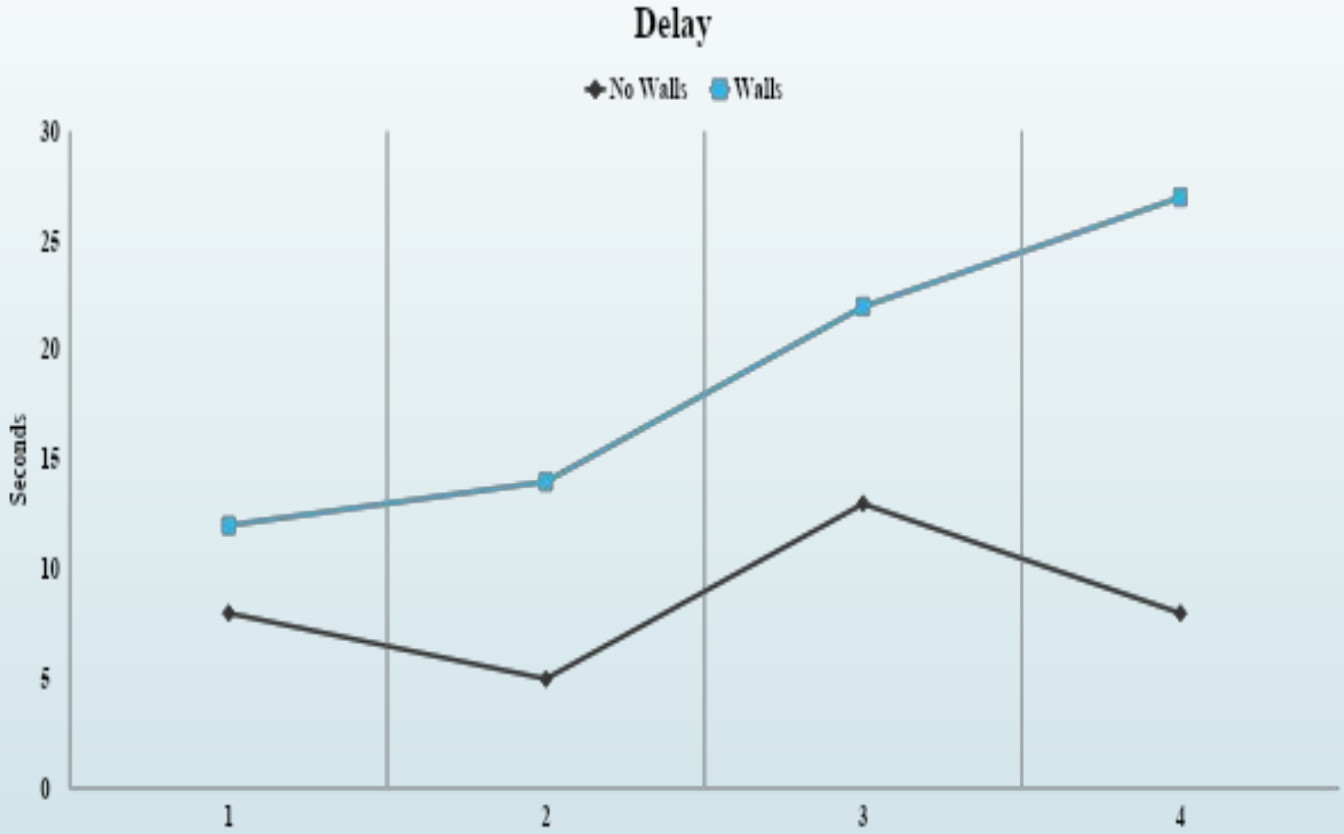


Figure (7): Delay (seconds) of Both Mesh and Extender network with and without walls

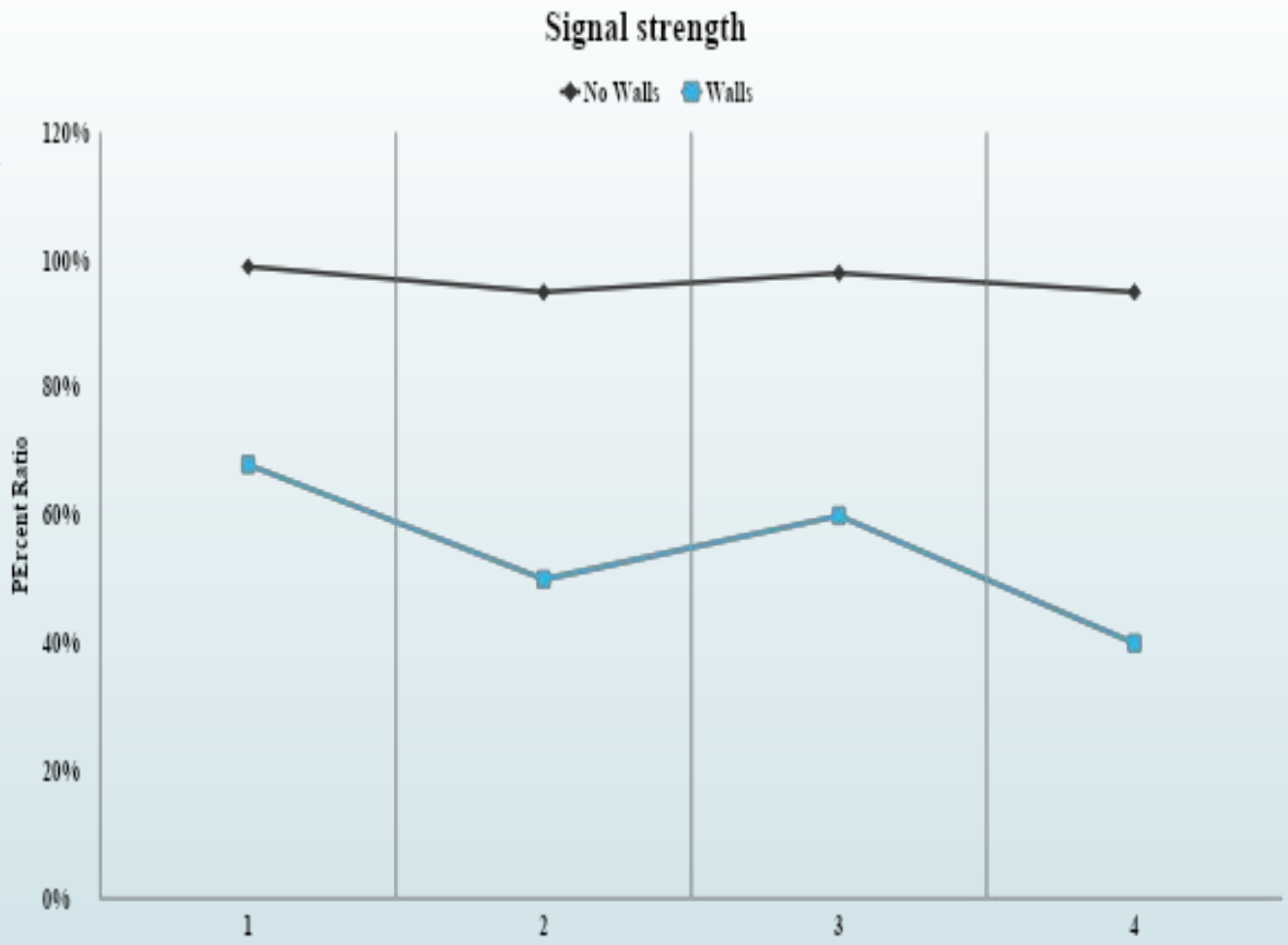


Figure (8): Signal Strength of Both Mesh and Extender network with and without walls

Conclusion

The result shows that the best Wi-Fi booster for IEEE 802.11ax is Wi-Fi mesh connection as it keeps the signal strength as high as possible in both 5GHz and 2.4GHz, while 5GHz gives lowest performance through walls. For Wi-Fi extenders, it gives lower performance compared to Wi-Fi mesh networks as it's suited for very short coverage with lower walls as possible.

- Finally other factors can affect the overall performance of both 2.4 and 5 GHz such as, WIFI interference, more routers that transmit same signal in the same area, concrete, masonry, metal walls, source and destination wireless adapter compatibility, movement of receiver host, distance between source and destination

Future work

- it's recommended to test more result and metrics for the IEEE 802.11ax and comparing it with older version in different user environment,
- also its recommended to user more advance varying technology such as MANET, VANET, and FANET to measure the fast-changing topology impact of the IEEE 802.11ax performance