# Improving Online Game Performance over IEEE 802.11n Networks

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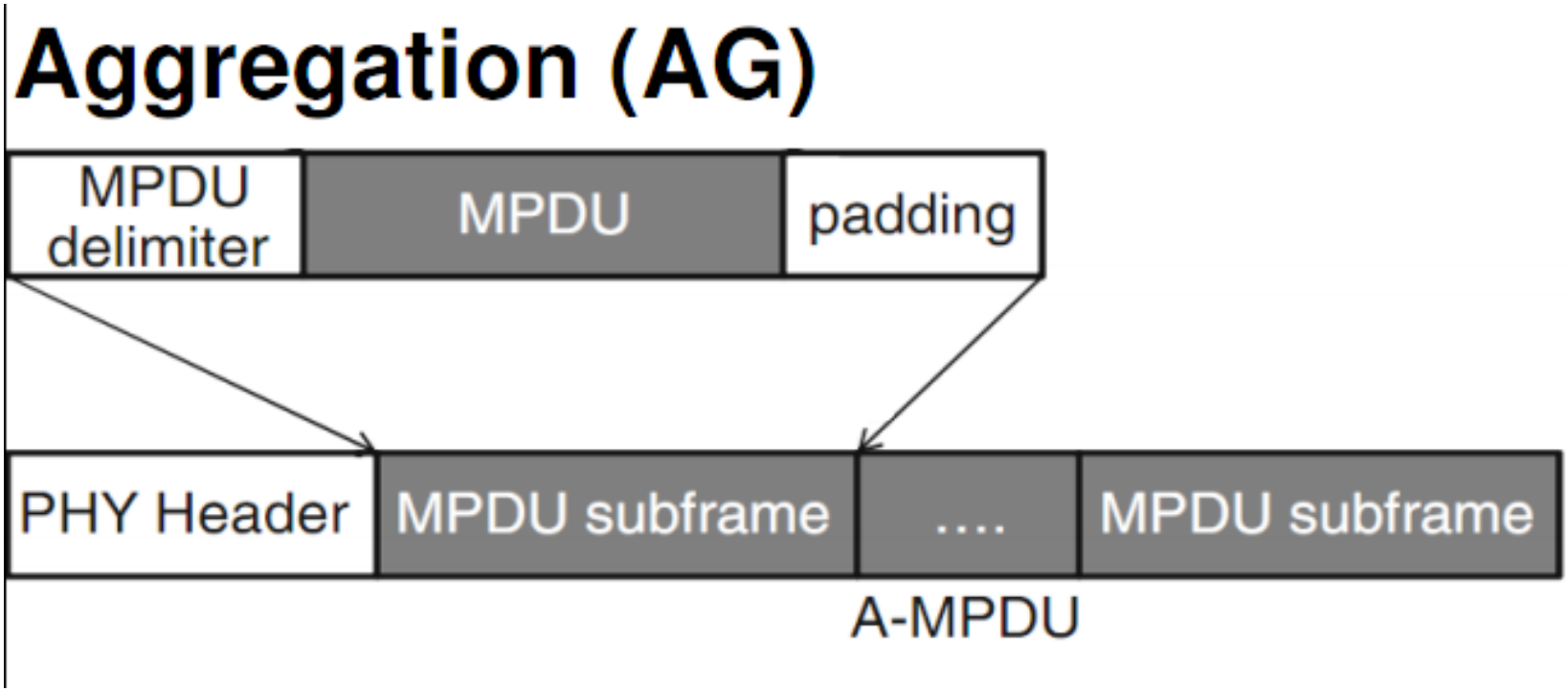
# Problem

- Under heavy background traffic, online game packets will encounter high queuing delay, jitter and even dropped in the bottleneck AP
- Using ns2 simulator, we apply IEEE 802.11n to WLAN to investigate the efficiency of these mechanisms in improving online game performance

# Introduction



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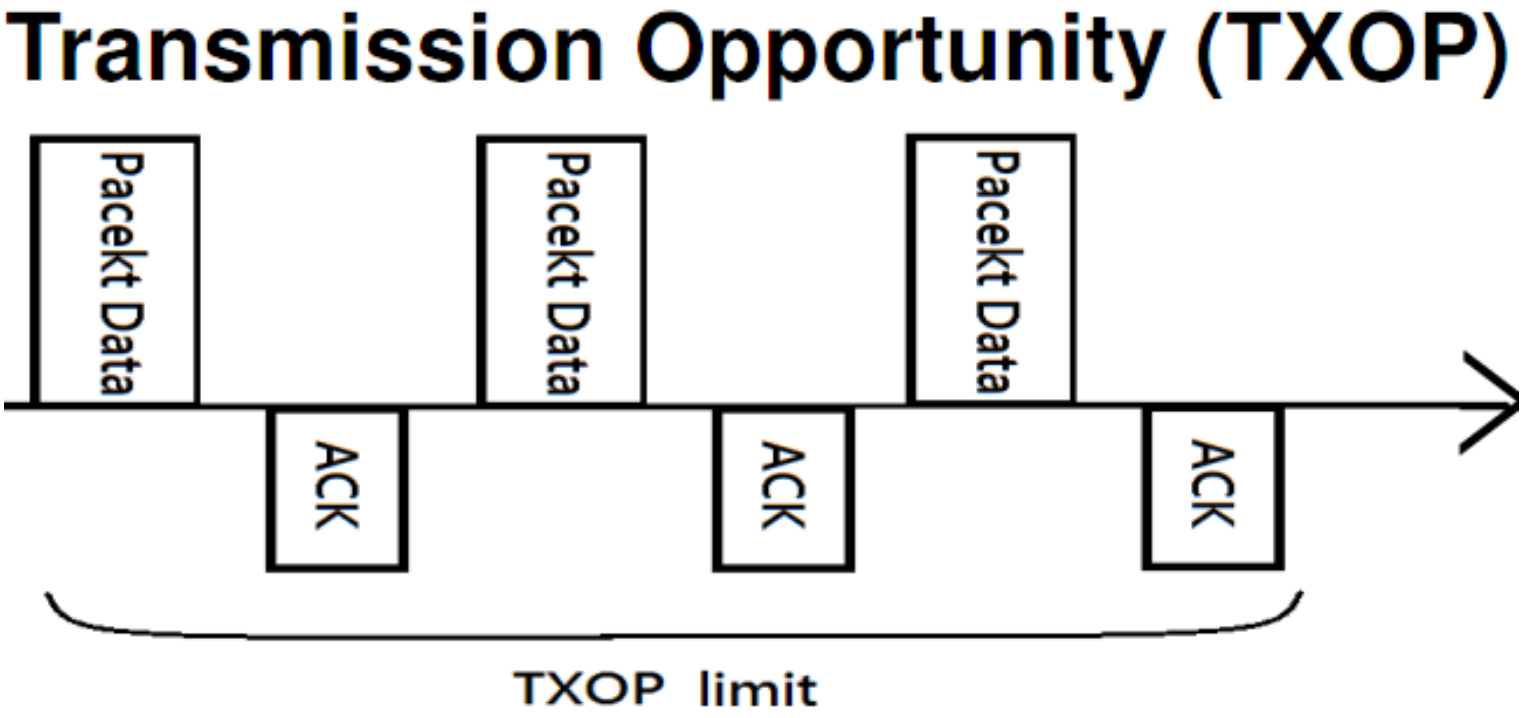

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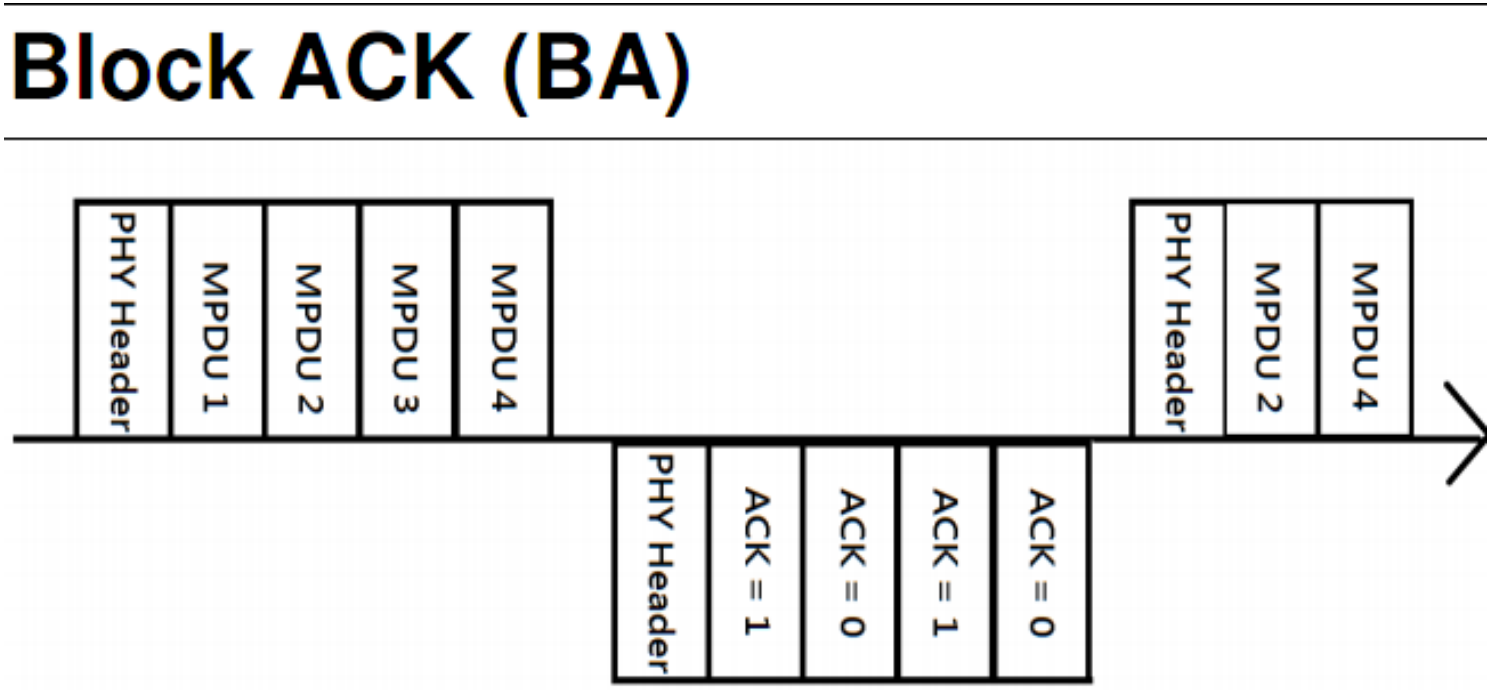

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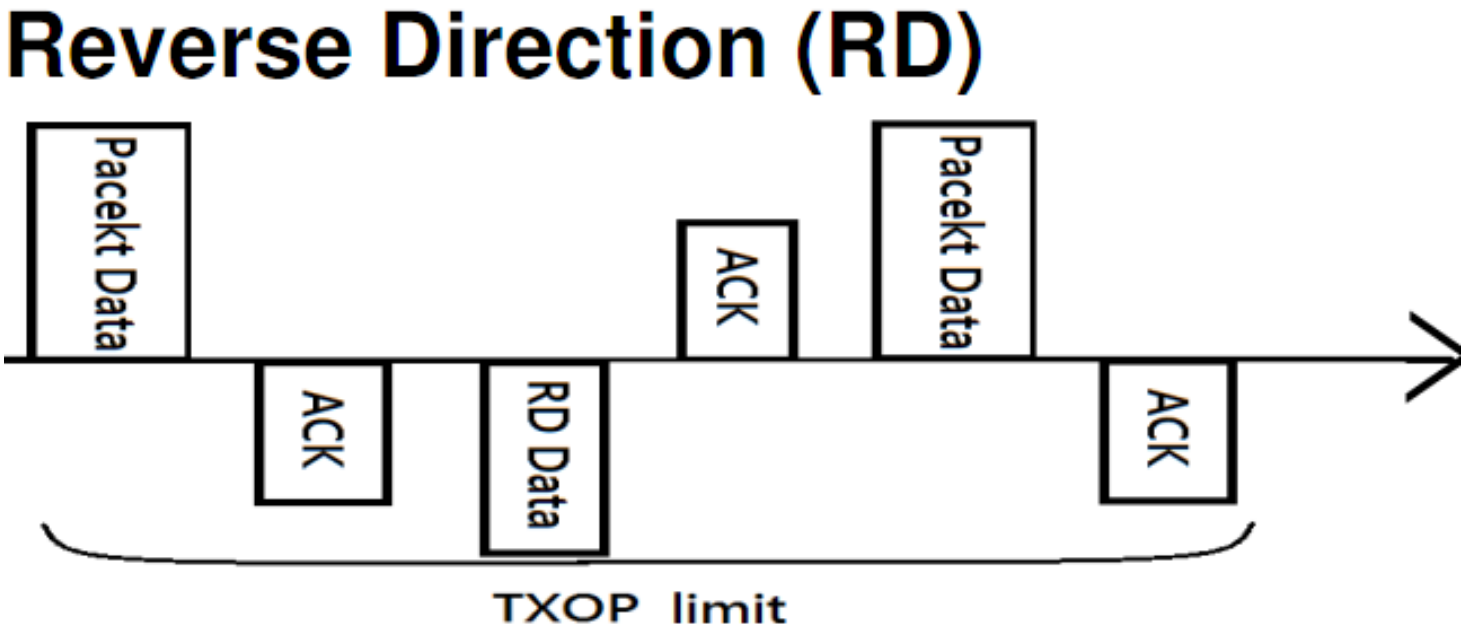

# Simulation Settings

| Traffic model | Uplink Packet interval | Uplink Packet size | Downlink Packet interval | Downlink Packet size |
|---|---|---|---|---|
| **Online Game** | 50 ms | 42 Bytes | 60 ms | 87 Bytes |

- **AP**: AG, TXOP
- **Game Clients**: BA, RD
- **Other wireless nodes**: BA

| Traffic | Uplink Load | Downlink Load |
|---|---|---|
| **Background** | 2 Mbps | variable |

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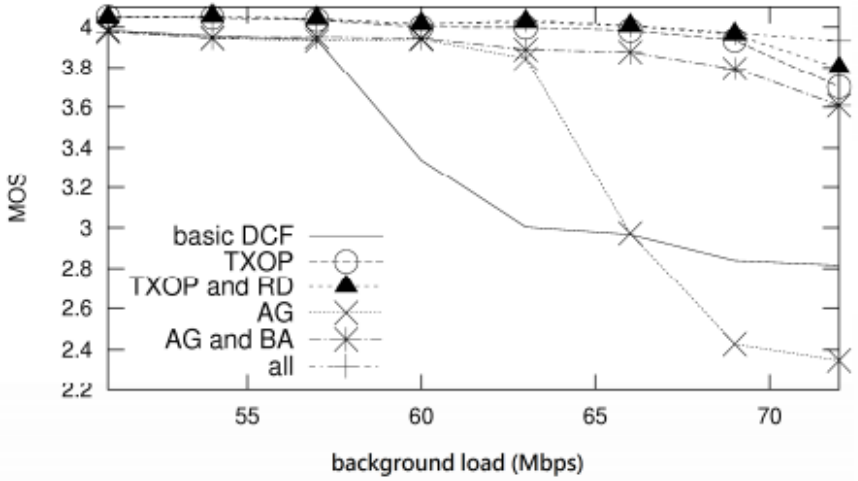
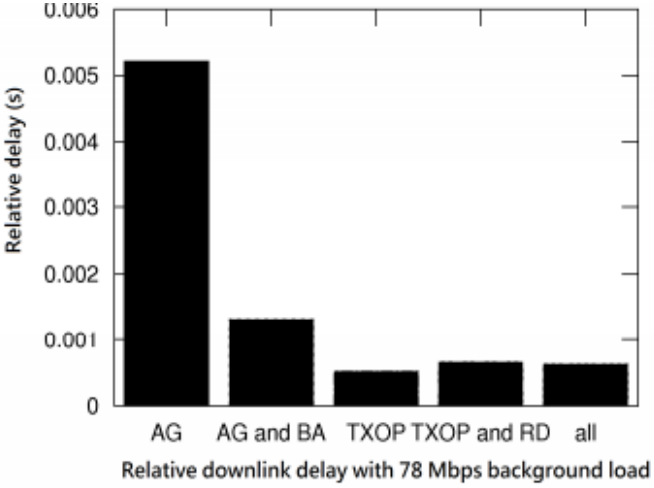
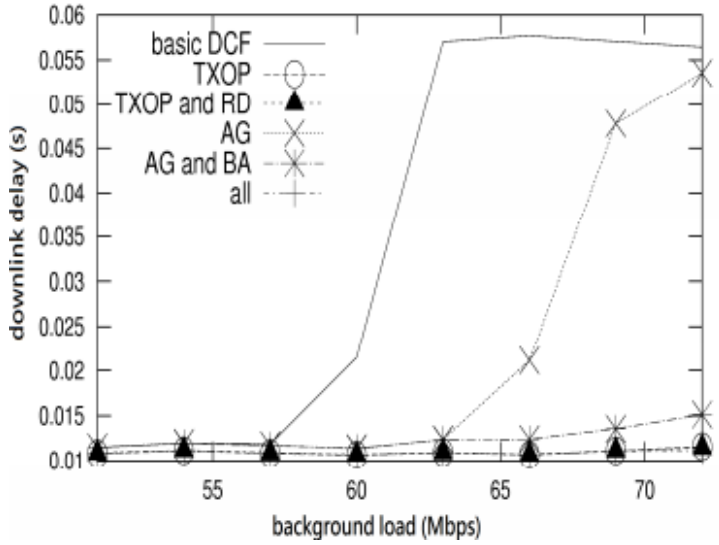
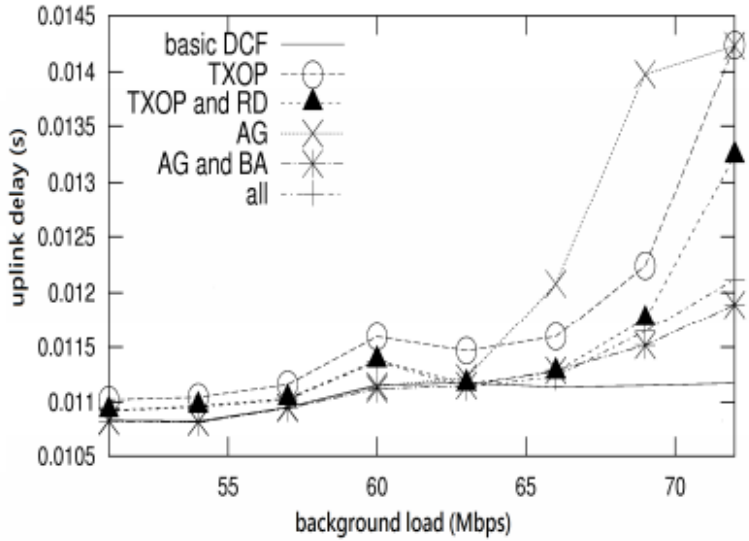
Tools Appl, 2004.

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## Aggregation and Block ACK

- Queuing congestion in AP is relieved by aggregating background traffic
- Block ACK overcomes the drawback of Aggregation
- Short Aggregation waiting time is suitable
- Aggregation is not for long-interval online game traffic

## TXOP and Reverse Direction

- TXOP can also alleviate queuing congestion significantly
- In AP's TXOP limit period online game clients cannot access channel
- Reverse Direction allows online game clients to send out uplink packets

## Comparison

- Generally TXOP with RD outperforms aggregation with block ACK
- Since downlink game packets hardly get aggregated, the transmissions between these packets still consist of channel contention overheads.
- Applying TXOP, these packets can be transmitted sequentially in the same TXOP period in which no contention is between the transmissions
- TXOP yields shorter downlink delay and improves network fairness

## Conclusion

- Both AG and TXOP can alleviate queuing congestion in the bottleneck AP
- BA and RD can overcome the drawback of AG and TXOP respectively
- TXOP is capable of improving network fairness by reducing relative downlink delay