

Wi-Fi Technology Fundamentals



WI-FI TECHNOLOGY
FUNDAMENTALS COURSE

Module-2

WLAN Physical Layer

Session-2c

MCS Table / PHY Data Rates and Throughput

Last Session Recap.....



Module-2 WLAN Physical Layer Session-2b **Modulation/Coding , MIMO Basics**

- ✓ PSK, QAM Modulations
- ✓ Throughput/Reliability Tradeoff
- ✓ Tx Power, RSSI, EVM, SNR
- ✓ Coding Techniques
- ✓ OFDM, Multipath, MIMO

Advertised Speeds



NETGEAR RAX10 WiFi 6 Router

4 simultaneous WiFi streams

4x more device capacity

1.8 Gbps WiFi speed

The image shows a black Netgear RAX10 WiFi 6 Router with four antennas, sitting on a desk in a modern office setting. The router has the Netgear logo and several green status lights on its top surface. The background is a blurred office desk with a computer monitor and a chair.

Wi-Fi Data Rates across generations

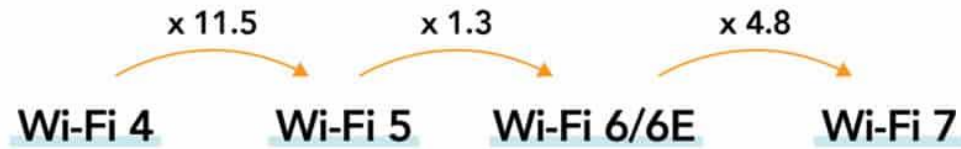
	Wi-Fi 4 (IEEE 802.11n)	Wi-Fi 5 (IEEE 802.11ac)	Wi-Fi 6 (IEEE 802.11ax)	Wi-Fi 6E (IEEE 802.11ax)	Wi-Fi 7 (IEEE 802.11be)
Frequency bands operations	2.4GHz (2.402 – 2.494) 5GHz (5.030 – 5.990)	5GHz (5.030 – 5.990)	2.4GHz (2.402 – 2.494) 5GHz (5.030 – 5.990)	2.4GHz (2.402 – 2.494) 5GHz (5.030 – 5.990) 6GHz (5.925 – 7.125)	2.4GHz (2.402 – 2.494) 5GHz (5.030 – 5.990) 6GHz (5.925 – 7.125)
Maximum bandwidth per channel	2.4GHz: 40MHz 5GHz: 40MHz	2.4GHz: 40MHz 5GHz: 80MHz	2.4GHz: 40MHz 5GHz: 160MHz	2.4GHz: 40MHz 5GHz: 160MHz 6GHz: 160MHz	2.4GHz: 40MHz 5GHz: 160MHz 6GHz: 320MHz
Maximum number of non-overlapping channels	2.4GHz: 2	5GHz: 5 (80MHz)	2.4GHz: 2 (40MHz) 5GHz: 2 (160MHz), or 5 (80MHz)	2.4GHz: 2 (40MHz) 5GHz: 2 (160MHz), or 5 (80MHz) 6GHz: 7 (160MHz), or 14 (80MHz)	2.4GHz: 2 (40MHz) 5GHz: 2 (160MHz), or 5 (80MHz) 6GHz: 3 (320MHz), or 7 (160MHz), or 14 (80MHz)
Maximum MIMO configuration	4x4	4x4	8x8	8x8	16x16
Highest modulation	64 QAM	256 QAM	1024 QAM (1K QAM)	1024 QAM (1K QAM)	4096 QAM (4K QAM)
Maximum PHY data rate	600 Mbps	1.7 Gbps	9.6 Gbps	9.6 Gbps	46.1 Gbps
Multi user MIMO (MU-MIMO)	N/A	Downlink (Wave 2 only)	Downlink Uplink	Downlink Uplink	Downlink Uplink
Multi user OFDMA (bandwidth sharing)	N/A	N/A	Yes	Yes	Yes
Target Wake Time (TWT)	N/A	N/A	Yes	Yes	Yes (improved)
Multi Link Operation / Multi Resource Unit	N/A	N/A	N/A	N/A	Yes

Wi-Fi generations

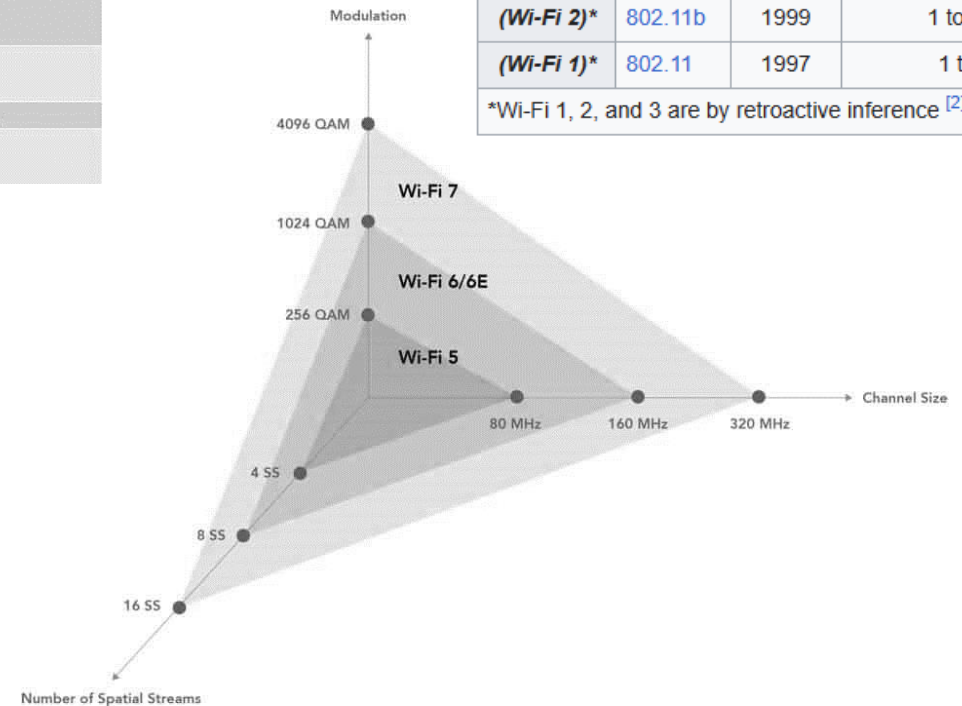
V · T · E

Generation	IEEE standard	Adopted	Maximum link rate (Mbit/s)	Radio frequency (GHz)
Wi-Fi 7	802.11be	(2024)	1376 to 46120	2.4/5/6
Wi-Fi 6E	802.11ax	2020	574 to 9608 ^[1]	6 ^[a]
Wi-Fi 6		2019		2.4/5
Wi-Fi 5	802.11ac	2014	433 to 6933	5 ^[b]
Wi-Fi 4	802.11n	2008	72 to 600	2.4/5
(Wi-Fi 3)*	802.11g	2003	6 to 54	2.4
	802.11a	1999		5
(Wi-Fi 2)*	802.11b	1999	1 to 11	2.4
(Wi-Fi 1)*	802.11	1997	1 to 2	2.4

*Wi-Fi 1, 2, and 3 are by retroactive inference ^{[2][3][4][5][6]}



Standard	802.11n	802.11ac	802.11ax	802.11be
Max Speed with 1 Spatial Stream	150 Mbps	866.7 Mbps	1.2 Gbps	2.9 Gbps
Max Speed with 2 Spatial Streams	300 Mbps	1.73 Gbps	2.5 Gbps	5.8 Gbps
Max Speed with Max # Spatial Streams	600 Mbps	6.92 Gbps	9.6 Gbps	46.4 Gbps



What is an MCS Table?

MCS Table is used to calculate/list the possible PHY rates for the various Wi-Fi Standards

Modulation Rate	Coding Rate	Number of Spatial Streams	Channel Bandwidth	Guard Interval
BPSK	1/2	1x1	20 MHz	800 ns
QPSK	3/4	2x2	40 MHz	1600 ns
16QAM	5/6	4x4	80 MHz	3200 ns
64QAM		8x8	160 MHz	
256QAM		16x16	320 MHz	
1024QAM				
4096QAM				

Modulation Rate

Number of bits that can be carried on a symbol

Coding Rate

Rate of data/redundant bits transferred for Forward Error Correction

Number of Spatial Streams

Number of MIMO radios chains

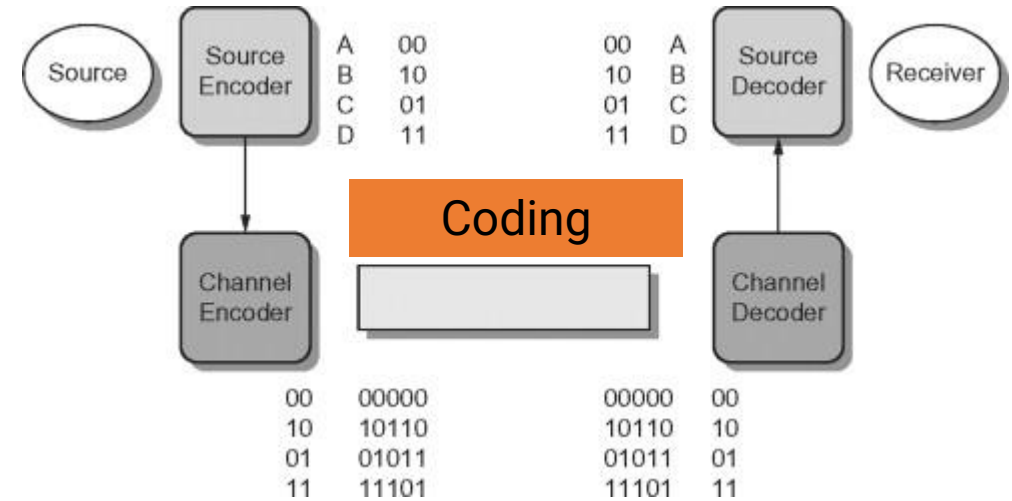
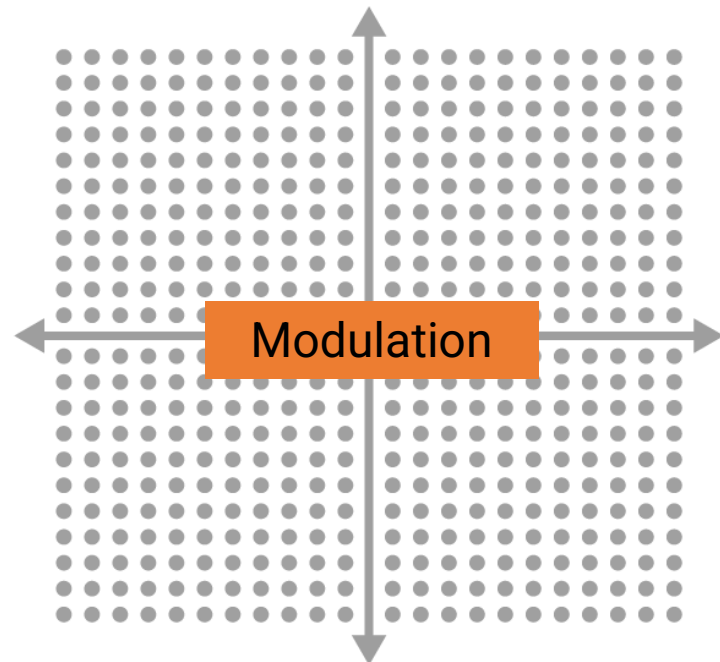
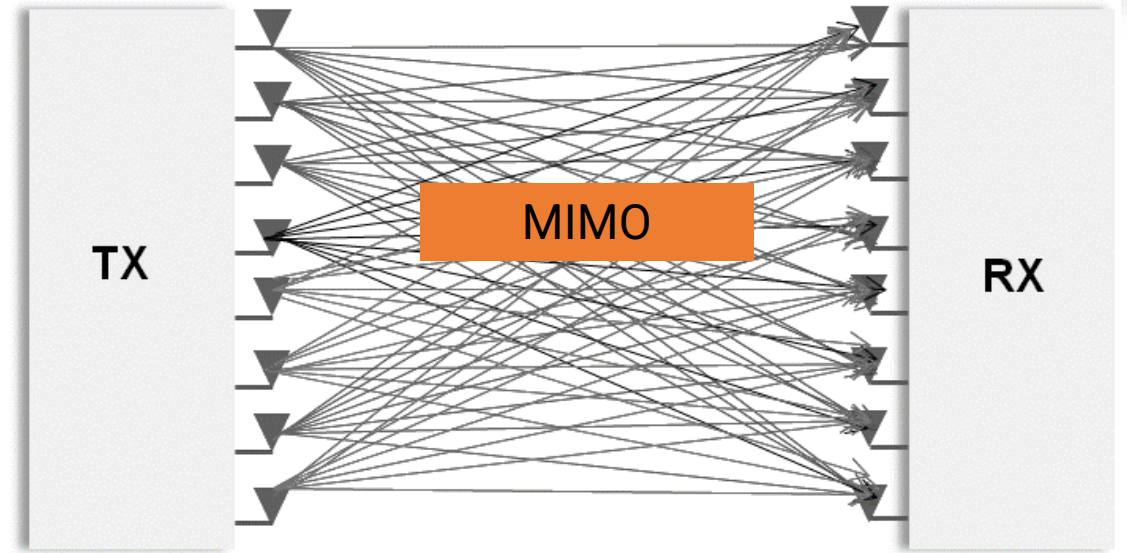
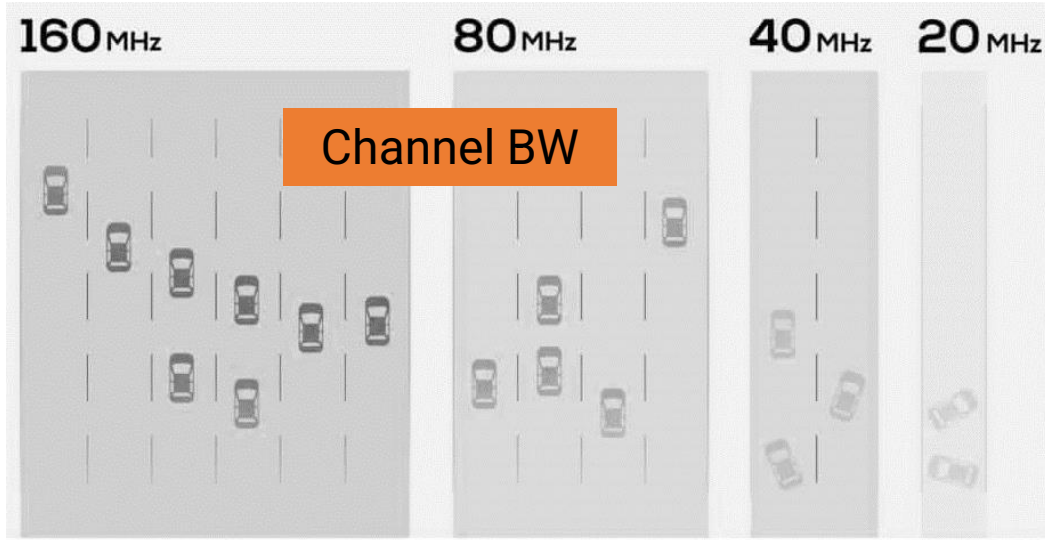
Channel BW

The width of the frequency BW used for single Tx/Rx

Guard Interval

Waiting time between each packet transmission. The smaller the guard interval, the faster the throughput

Data Rate Parameters

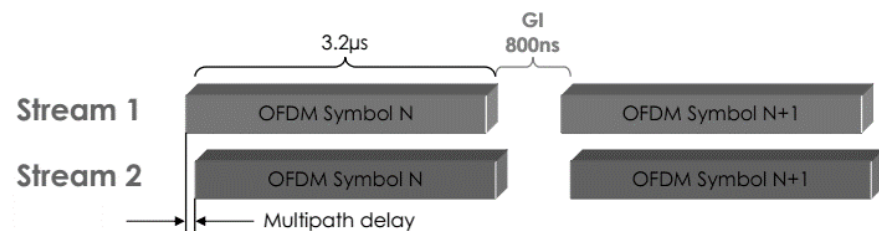


Guard Interval

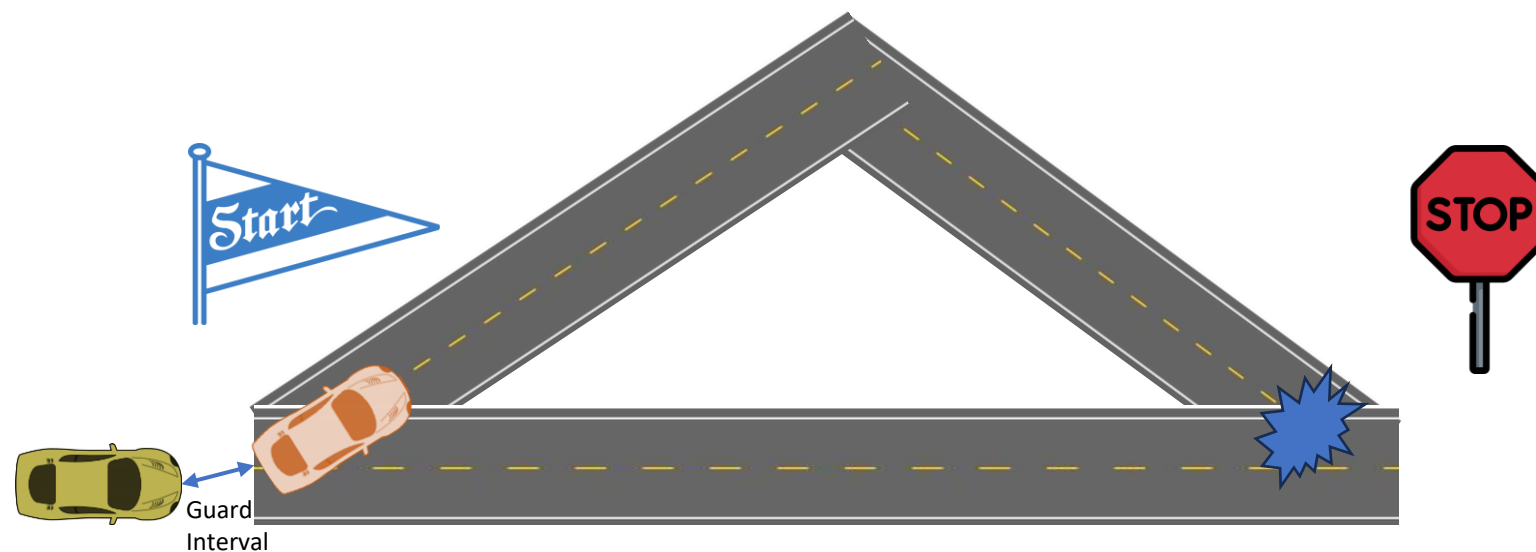
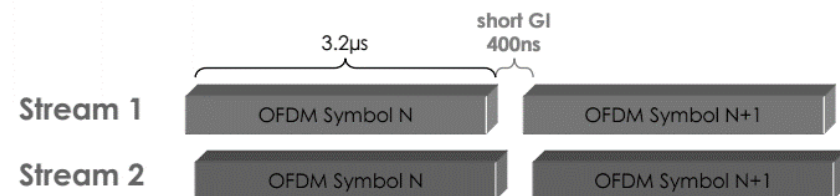
Guard intervals are used to ensure that distinct transmissions do not interfere with one another, or otherwise cause overlapping transmissions. These transmissions may belong to different users (as in TDMA) or to the same user (as in OFDM).

In OFDM, the beginning of each symbol is preceded by a guard interval. As long as the echoes fall within this interval, they will not affect the receiver's ability to safely decode the actual data, as data is only interpreted outside the guard interval.

Normal Guard Interval of 800ns



Short Guard Interval of 400ns



802.11a/b/g MCS Rates

	Data rate (Mbps)	Encoding	Chip length	Bits encoded	Modulation
DSSS	1	Barker coding	11	1	DBPSK
DSSS	2	Barker coding	11	1	DQPSK

Base 802.11

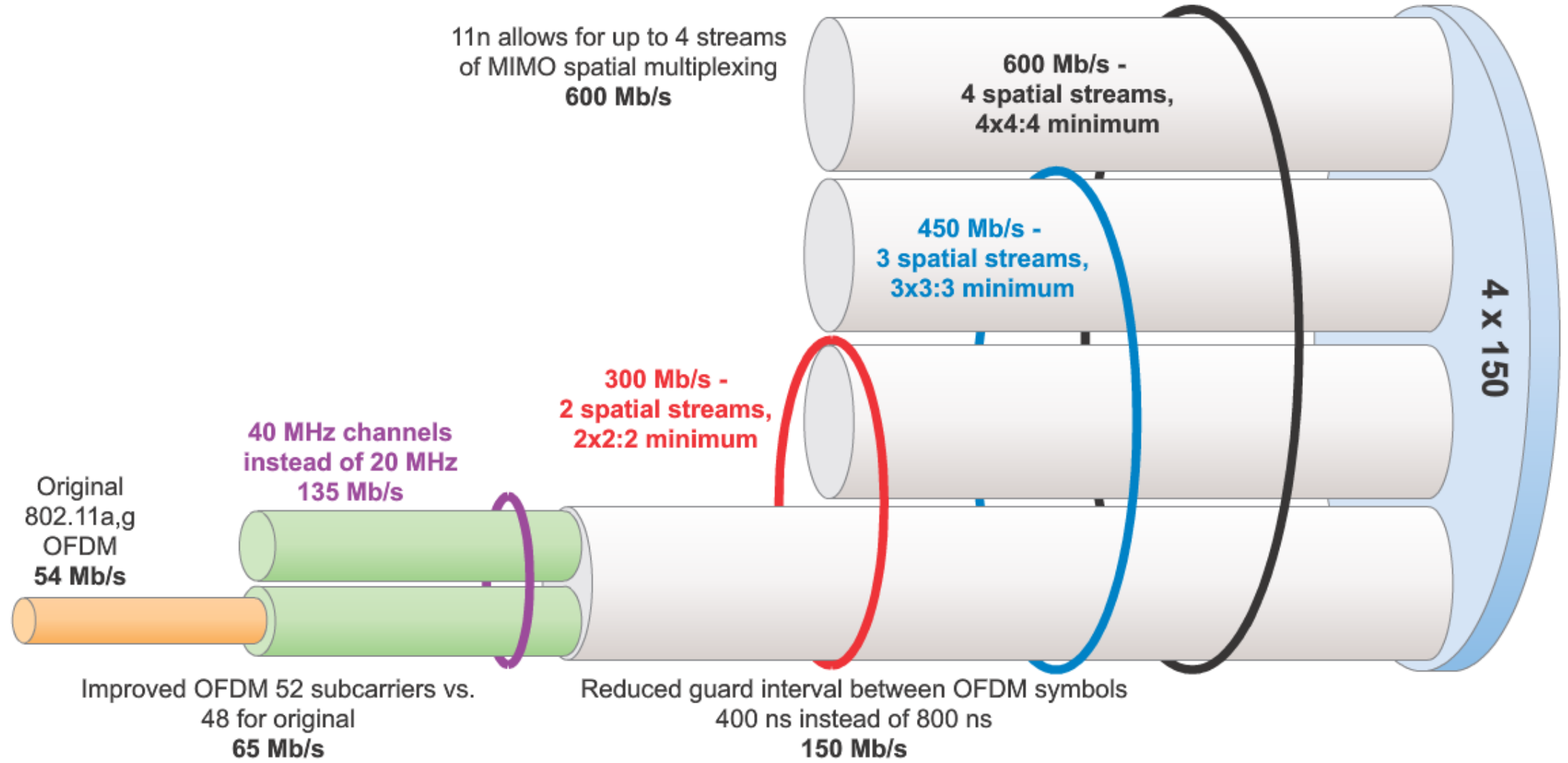
	Data rate (Mbps)	Encoding	Chip length	Bits encoded	Modulation
DSSS	1	Barker coding	11	1	DBPSK
DSSS	2	Barker coding	11	1	DQPSK
HR-DSSS	5.5	CCK coding	8	4	DQPSK
HR-DSSS	11	CCK coding	8	8	DQPSK

802.11b

Data rates (Mbps)	Modulation method	Coded bits per subcarrier	Data bits per OFDM symbol	Coded bits per OFDM symbol	Coding rate (data bits/coded bits)
6	BPSK	1	24	48	1/2
9	BPSK	1	36	48	3/4
12	QPSK	2	48	96	1/2
18	QPSK	2	72	96	3/4
24	16-QAM	4	96	192	1/2
36	16-QAM	4	144	192	3/4
48	64-QAM	6	192	288	2/3
54	64-QAM	6	216	288	3/4

802.11a/g

802.11n(Wi-Fi4) Data Rates



802.11n(Wi-Fi4) MCS Table

MCS index	Spatial streams	Modulation type	Coding rate	Data rate (Mbit/s)			
				20 MHz channel		40 MHz channel	
				800 ns GI	400 ns GI	800 ns GI	400 ns GI
0	1	BPSK	1/2	6.50	7.20	13.50	15.00
1	1	QPSK	1/2	13.00	14.40	27.00	30.00
2	1	QPSK	3/4	19.50	21.70	40.50	45.00
3	1	16-QAM	1/2	26.00	28.90	54.00	60.00
4	1	16-QAM	3/4	39.00	43.30	81.00	90.00
5	1	64-QAM	2/3	52.00	57.80	108.00	120.00
6	1	64-QAM	3/4	58.50	65.00	121.50	135.00
7	1	64-QAM	5/6	65.00	72.20	135.00	150.00
8	2	BPSK	1/2	13.00	14.40	27.00	30.00
9	2	QPSK	1/2	26.00	28.90	54.00	60.00
10	2	QPSK	3/4	39.00	43.30	81.00	90.00
11	2	16-QAM	1/2	52.00	57.80	108.00	120.00
12	2	16-QAM	3/4	78.00	86.70	162.00	180.00
13	2	64-QAM	2/3	104.00	115.60	216.00	240.00
14	2	64-QAM	3/4	117.00	130.00	243.00	270.00
15	2	64-QAM	5/6	130.00	144.40	270.00	300.00

MCS index	Spatial streams	Modulation type	Coding rate	Data rate (Mbit/s)			
				20 MHz channel		40 MHz channel	
				800 ns GI	400 ns GI	800 ns GI	400 ns GI
16	3	BPSK	1/2	19.50	21.70	40.50	45.00
17	3	QPSK	1/2	39.00	43.30	81.00	90.00
18	3	QPSK	3/4	58.50	65.00	121.50	135.00
19	3	16-QAM	1/2	78.00	86.70	162.00	180.00
20	3	16-QAM	3/4	117.00	130.70	243.00	270.00
21	3	64-QAM	2/3	156.00	173.30	324.00	360.00
22	3	64-QAM	3/4	175.50	195.00	364.50	405.00
23	3	64-QAM	5/6	195.00	216.70	405.00	450.00
24	4	BPSK	1/2	26.00	28.80	54.00	60.00
25	4	QPSK	1/2	52.00	57.60	108.00	120.00
26	4	QPSK	3/4	78.00	86.80	162.00	180.00
27	4	16-QAM	1/2	104.00	115.60	216.00	240.00
28	4	16-QAM	3/4	156.00	173.20	324.00	360.00
29	4	64-QAM	2/3	208.00	231.20	432.00	480.00
30	4	64-QAM	3/4	234.00	260.00	486.00	540.00
31	4	64-QAM	5/6	260.00	288.80	540.00	600.00

802.11ac(Wi-Fi5) MCS Table

- 80 MHz and 160 MHz channel bandwidths
- Support for up to 8 spatial streams
- Multi User MIMO
- 256-QAM Modulation, rate 3/4 and 5/6, added as optional modes
- Coexistence mechanisms for 20/40/80/160 MHz channels, 11ac and 11a/n devices

Example 802.11ac configurations (all rates assume 256-QAM, rate 5/6)

Scenario	Typical Client Form Factor	PHY Link Rate	Aggregate Capacity
1-antenna AP, 1-antenna STA, 80MHz	Handheld	433 Mbit/s	433 Mbit/s
2-antenna AP, 2-antenna STA, 80MHz	Tablet, Laptop	867 Mbit/s	867 Mbit/s
1-antenna AP, 1-antenna STA, 160MHz	Handheld	867 Mbit/s	867 Mbit/s
2-antenna AP, 2-antenna STA, 160MHz	Tablet, Laptop	1.73 Gbit/s	1.73 Gbit/s
4-antenna AP, 4 1-antenna STAs, 160MHz (MU-MIMO)	Handheld	867 Mbit/s to each STA	3.47 Gbit/s
8-antenna AP, 160MHz (MU-MIMO) -- 1 4-antenna STA -- 1 2-antenna STA -- 2 1-antenna STAs	Digital TV, Set-top Box, Tablet, Laptop, PC, Handheld	3.47 Gbit/s to 4-antenna STA 1.73 Gbit/s to 2-antenna STA 867 Mbit/s to each 1-antenna STA	6.93 Gbit/s
8-antenna AP, 4 2-antenna STAs, 160MHz (MU-MIMO)	Digital TV, Tablet, Laptop, PC	1.73 Gbit/s to each STA	6.93 Gbit/s

802.11ac (Wi-Fi5) Configurations

Channel bandwidth	Transmit – Receive antennas	Modulation and coding etc.	Typical client scenario	Throughput (individual link rate)	Throughput (aggregate link rate)
80 MHz	1x1	256-QAM 5/6, short guard interval	Smartphone	433 Mbps	433 Mbps
80 MHz	2x2	256-QAM 5/6, short guard interval	Tablet, PC	867 Mbps	867 Mbps
160 MHz	1x1	256-QAM 5/6, short guard interval	Smartphone	867 Mbps	867 Mbps
160 MHz	2x2	256-QAM 5/6, short guard interval	Tablet, PC	1.73 Gbps	1.73 Gbps
160 MHz	4x Tx AP, 4 clients of 1x Rx	256-QAM 5/6, short guard interval	Multiple smartphones	867 Mbps per client	3.47 Gbps
160 MHz	8x Tx AP, 4 clients with total of 8x Rx (with multi-user MIMO)	256-QAM 5/6, short guard interval	Digital TV, set-top box, tablet, PC, smartphone	867 Mbps to two 1x clients 1.73 Gbps to one 2x client 3.47 Gbps to one 4x client	6.93 Gbps
160 MHz	8x Tx AP, 4 clients of 2x Rx (with multi-user MIMO)	256-QAM 5/6, short guard interval	Multiple set-top boxes, PC	1.73 Gbps to each client	6.93 Gbps

MCS	Lowest rates Mbps (20 MHz channel, 1x SS)		Channel width	Spatial streams	Highest rates Mbps (160 MHz channel, 8x SS)	
	Long GI	Short GI			Long GI	Short GI
0	6.5	7.2	x2.1 for 40 MHz x4.5 for 80 MHz x9.0 for 160 MHz	x2 for 2 SS	468.0	520.0
1	13.0	14.4		x3 for 3 SS	939.0	1040.0
2	19.5	21.7		x4 for 4 SS	1404.0	1560.0
3	26.0	28.9		x5 for 5 SS	1872.0	2080.0
4	39.0	43.3		x6 for 6 SS	2808.0	3120.0
5	52.0	57.8		x7 for 7 SS	3744.0	4160.0
6	58.5	65.0		x8 for 8 SS	4212.0	4680.0
7	65.0	72.2			4680.0	5200.0
8	78.0	86.7			5616.0	6240.0
9	(86.7)	(96.3)		6240.0	6933.3	

Data rates for various 802.11ac configurations

802.11ax(Wi-Fi6 Data Rates)

Modulation and coding schemes for single spatial stream

MCS index ^[a]	Modulation type	Coding rate	Data rate (in Mbit/s) ^[b]							
			20 MHz channels		40 MHz channels		80 MHz channels		160 MHz channels	
			1600 ns GI ^[c]	800 ns GI	1600 ns GI	800 ns GI	1600 ns GI	800 ns GI	1600 ns GI	800 ns GI
0	BPSK	1/2	8	8.6	16	17.2	34	36.0	68	72
1	QPSK	1/2	16	17.2	33	34.4	68	72.1	136	144
2	QPSK	3/4	24	25.8	49	51.6	102	108.1	204	216
3	16-QAM	1/2	33	34.4	65	68.8	136	144.1	272	282
4	16-QAM	3/4	49	51.6	98	103.2	204	216.2	408	432
5	64-QAM	2/3	65	68.8	130	137.6	272	288.2	544	576
6	64-QAM	3/4	73	77.4	146	154.9	306	324.4	613	649
7	64-QAM	5/6	81	86.0	163	172.1	340	360.3	681	721
8	256-QAM	3/4	98	103.2	195	206.5	408	432.4	817	865
9	256-QAM	5/6	108	114.7	217	229.4	453	480.4	907	961
10	1024-QAM	3/4	122	129.0	244	258.1	510	540.4	1021	1081
11	1024-QAM	5/6	135	143.4	271	286.8	567	600.5	1134	1201

Notes

- ^ MCS 9 is not applicable to all channel width/spatial stream combinations.
- ^ A second stream doubles the theoretical data rate, a third one triples it, etc.
- ^ GI stands for the guard interval.

802.11be (Wi-Fi7) Data Rates

MCS index ^[i]	Modulation type	Coding rate	Data rate (Mbit/s) ^[ii]														
			20 MHz channels			40 MHz channels			80 MHz channels			160 MHz channels			320 MHz channels		
			3200 ns GI ^[iii]	1600 ns GI	800 ns GI	3200 ns GI	1600 ns GI	800 ns GI	3200 ns GI	1600 ns GI	800 ns GI	3200 ns GI	1600 ns GI	800 ns GI	3200 ns GI	1600 ns GI	800 ns GI
0	BPSK	1/2	7	8	9	15	16	17	31	34	36	61	68	72	123	136	144
1	QPSK	1/2	15	16	17	29	33	34	61	68	72	122	136	144	245	272	288
2	QPSK	3/4	22	24	26	44	49	52	92	102	108	184	204	216	368	408	432
3	16-QAM	1/2	29	33	34	59	65	69	123	136	144	245	272	282	490	544	577
4	16-QAM	3/4	44	49	52	88	98	103	184	204	216	368	408	432	735	817	865
5	64-QAM	2/3	59	65	69	117	130	138	245	272	288	490	544	576	980	1089	1153
6	64-QAM	3/4	66	73	77	132	146	155	276	306	324	551	613	649	1103	1225	1297
7	64-QAM	5/6	73	81	86	146	163	172	306	340	360	613	681	721	1225	1361	1441
8	256-QAM	3/4	88	98	103	176	195	207	368	408	432	735	817	865	1470	1633	1729
9	256-QAM	5/6	98	108	115	195	217	229	408	453	480	817	907	961	1633	1815	1922
10	1024-QAM	3/4	110	122	129	219	244	258	459	510	540	919	1021	1081	1838	2042	2162
11	1024-QAM	5/6	122	135	143	244	271	287	510	567	600	1021	1134	1201	2042	2269	2402
12	4096-QAM	3/4	131	146	155	263	293	310	551	613	649	1103	1225	1297	2205	2450	2594
13	4096-QAM	5/6	146	163	172	293	325	344	613	681	721	1225	1361	1441	2450	2722	2882

Full MCS Table



https://docs.google.com/spreadsheets/d/e/2PACX-1vQXoEYLGWwR1aGyGaTXOOaDQSPfC4rv70KRfURP6eZ5fL-Ku_Y16DgS6zZMNyIhQpQmKQ107abij/pubhtml?gid=1367372895&single=true

<https://semfonetworks.com/blog/mcs-table-updated-with-80211ax-data-rates/>

MCS Index	Coding	Modulation	Constellation	BPSK (1 TBS)										QPSK (2 TBS)										16-QAM (4 TBS)										64-QAM (8 TBS)										256-QAM (16 TBS)																																								
				1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10																															
0	1	1	BPSK	1/2	6.0	7.2	8.4	9.6	10.8	12.0	13.2	14.4	15.6	16.8	18.0	19.2	20.4	21.6	22.8	24.0	25.2	26.4	27.6	28.8	30.0	31.2	32.4	33.6	34.8	36.0	37.2	38.4	39.6	40.8	42.0	43.2	44.4	45.6	46.8	48.0	49.2	50.4	51.6	52.8	54.0	55.2	56.4	57.6	58.8	60.0	61.2	62.4	63.6	64.8	66.0	67.2	68.4	69.6	70.8	72.0	73.2	74.4	75.6	76.8	78.0	79.2	80.4	81.6	82.8	84.0	85.2	86.4	87.6	88.8	90.0	91.2	92.4	93.6	94.8	96.0	97.2	98.4	99.6	100.0

The PHY Data Rates Calculations

$$\text{Data Rate} = \frac{N_{SD} * N_{BPSCS} * R * N_{SS}}{T_{DFT} + T_{GI}}$$

Number of Data Subcarriers: N_{SD}
 Number of Coded Bits per Subcarrier per Stream: N_{BPSCS}
 Coding: R
 Number of Spatial Streams: N_{SS}
 T_{DFT} : OFDM Symbol Duration
 T_{GI} : Guard Interval Duration

PHY	Modulation		R	N_{SS}	N_{SD}				T_{DFT}	T_{GI}	
	Name	N_{BPSCS}			20MHz	40MHz	80MHz	160MHz		Long	Short
802.11n (HT)	BPSK	1	1/2	1 to 4	52	108	234	468	3.2 μ s	0.8 μ s	0.4 μ s
	QPSK	2	1/2 & 3/4								
	16-QAM	4	1/2 & 3/4								
	64-QAM	6	1/2 & 2/3 & 3/4								
802.11ac (VHT)	BPSK	1	1/2	1 to 8	52	108	234	468	3.2 μ s	0.8 μ s	0.4 μ s
	QPSK	2	1/2 & 3/4								
	16-QAM	4	1/2 & 3/4								
	64-QAM	6	1/2 & 2/3 & 3/4								
	256-QAM	8	2/3 & 5/6								

PHY	Modulation		R	N_{SS}	N_{SD}				T_{DFT}	T_{GI}		
	Name	N_{BPSCS}			20MHz	40MHz	80MHz	160MHz		Long	Medium	Long
802.11ax (HE)	BPSK	1	1/2	1 to 8	234	468	980	1960	12.8 μ s	0.8 μ s	1.2 μ s	3.2 μ s
	QPSK	2	1/2 & 3/4									
	16-QAM	4	1/2 & 3/4									
	64-QAM	6	1/2 & 2/3 & 3/4									
	256-QAM	8	2/3 & 5/6									
	1024-QAM	10	3/4 & 5/6									

Difference between PHY Data Rates and Throughput

The actual Throughput under ideal conditions is expected to be around 60-70% of the PHY data rates.

Wi-Fi Overhead

- Interframe Spaces
- Management and Control Frames
- Random Backoff
- PHY Signaling
- Interference
- MAC Header
- Guard Intervals
- Virtual Carrier Sensing
- Backward Compatibility/Legacy Mode
- Acknowledgements
- Retransmissions
- Rate Adaptation
- Packet sizes/Frame sizes
- Half Duplex

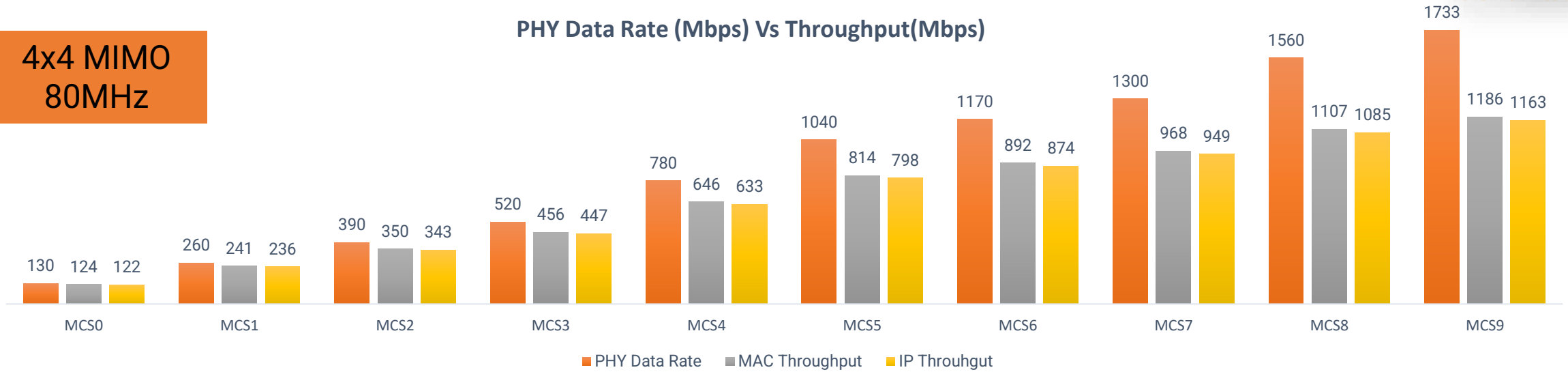


PHY Data Rates Vs Actual Throughput

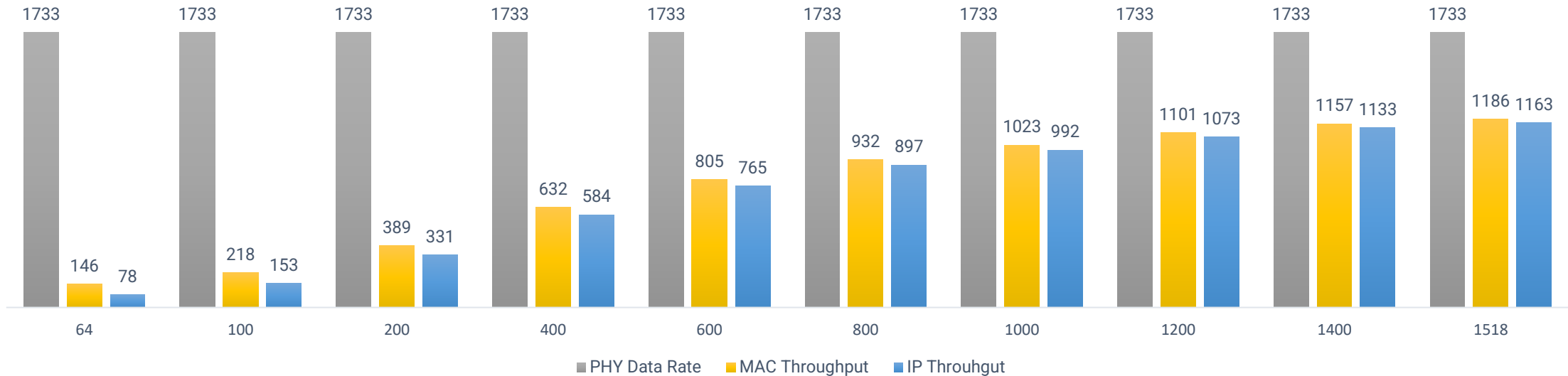


4x4 MIMO
80MHz

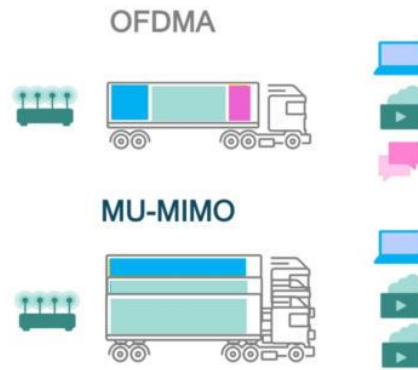
PHY Data Rate (Mbps) Vs Throughput(Mbps)



PHY Data Rate(Mbps) compared with Throughput(Mbps) at different frame sizes at MCS9



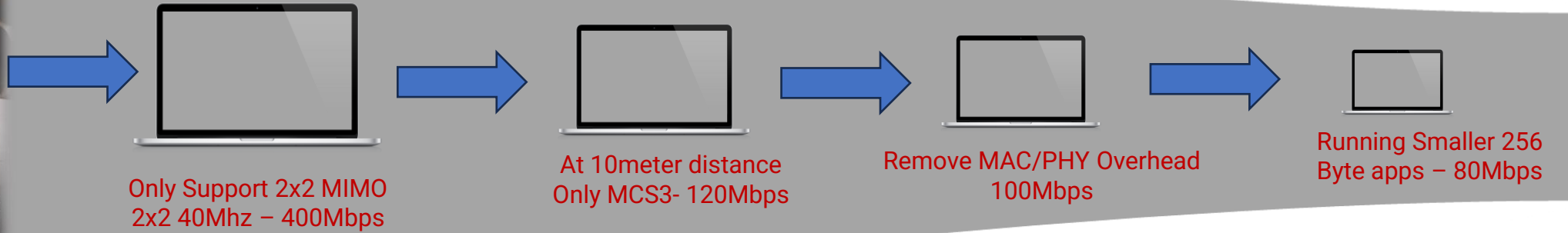
The Real Throughput



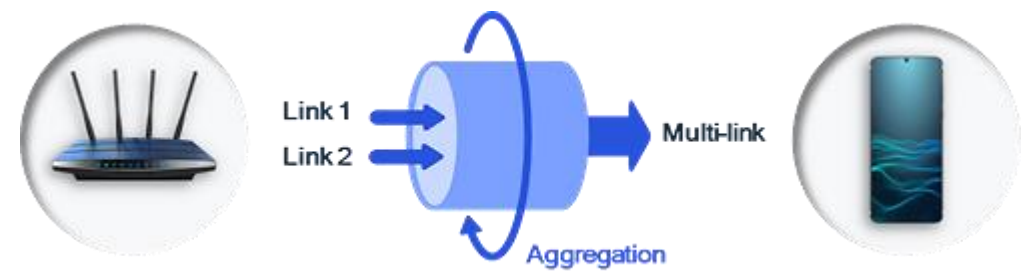
- OFDMA increases efficiency
- OFDMA reduces latency
- Ideal for low-bandwidth applications

- MU-MIMO increases capacity
- MU-MIMO results in higher speeds per user
- Ideal for high-bandwidth applications

MU-MIMO is similar to multiple trucks serving users simultaneously



What is on the Box
4x4 MIMO 80MHz 11ac –
1733 Mbps



Multi-Link Operation

The Real Throughput Example



11 Gbps Router

802.11b: up to 11 Mbps
 802.11a/g: up to 54 Mbps
 802.11n: up to 600 Mbps
 802.11ac: up to 1733 Mbps
 802.11ax (2.4GHz): up to 1148 Mbps
 802.11ax (5GHz): up to 4804 Mbps
 802.11ax (6GHz): up to 4804 Mbps

ROG Rapture GT-AX11000

AX11000 Tri-band WiFi 6 Gaming Router – World's first 10 Gigabit WiFi router with a quad-core CPU, PS5 compatible, 2.5G port, DFS band, wtfast, Adaptive QoS, AiMesh for mesh wifi system and free network security

- **Next-Gen WiFi Standard** - 802.11ax WiFi standard for better efficiency, throughput and range.
- **Ultrafast WiFi Speed** - 11000Mbps WiFi speed to handle even the busiest network with ease.
- **Triple-level Game Acceleration** – Accelerate game traffic every step of the way - from device to game server.
- **Battle-ready-hardware** – 1.8GHz quad-core CPU and 2.5GBase -T port for ultimate performance.
- **Front-line Network Security** – Neutralize internet threats before they hit your network.

802.11ax

2x2 MIMO 80MHz 1024 QAM
 Theoretical Rate: 1201 Mbps

802.11ac

2x2 MIMO 80MHz 256 QAM
 Theoretical Rate: 866 Mbps

802.11n

2x2 MIMO 40MHz 64 QAM
 Theoretical Rate: 300 Mbps

802.11bg

1x1 MIMO 20MHz 64 QAM
 Theoretical Rate: 54 Mbps



References

Theoretical Data Rates vs Real World Throughput

<https://www.duckware.com/tech/wifi-in-the-us.html>

MCS Table

<https://mcsindex.com/>

WiFi7 Theoretical Throughput Calculator

<https://www.rfwireless-world.com/calculators/WiFi7-802-11be-data-rate-throughput-calculator.html>

Wi-Fi Guard Interval

[https://en.wikipedia.org/wiki/Guard_interval#:~:text=The%20shortest%20interval%20\(1%2F32,delay%20spread%20of%20the%20channel.](https://en.wikipedia.org/wiki/Guard_interval#:~:text=The%20shortest%20interval%20(1%2F32,delay%20spread%20of%20the%20channel.)

Wi-Fi7 (802.11be) Wiki Page

https://en.wikipedia.org/wiki/IEEE_802.11be

Q&A



QUIZ!

TIME

Quiz 2b Results

Number of participants - 167



Winner
S Sushmitha
India

