The Nuts and Bolts of a WiFi AP

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WiFi Product Management

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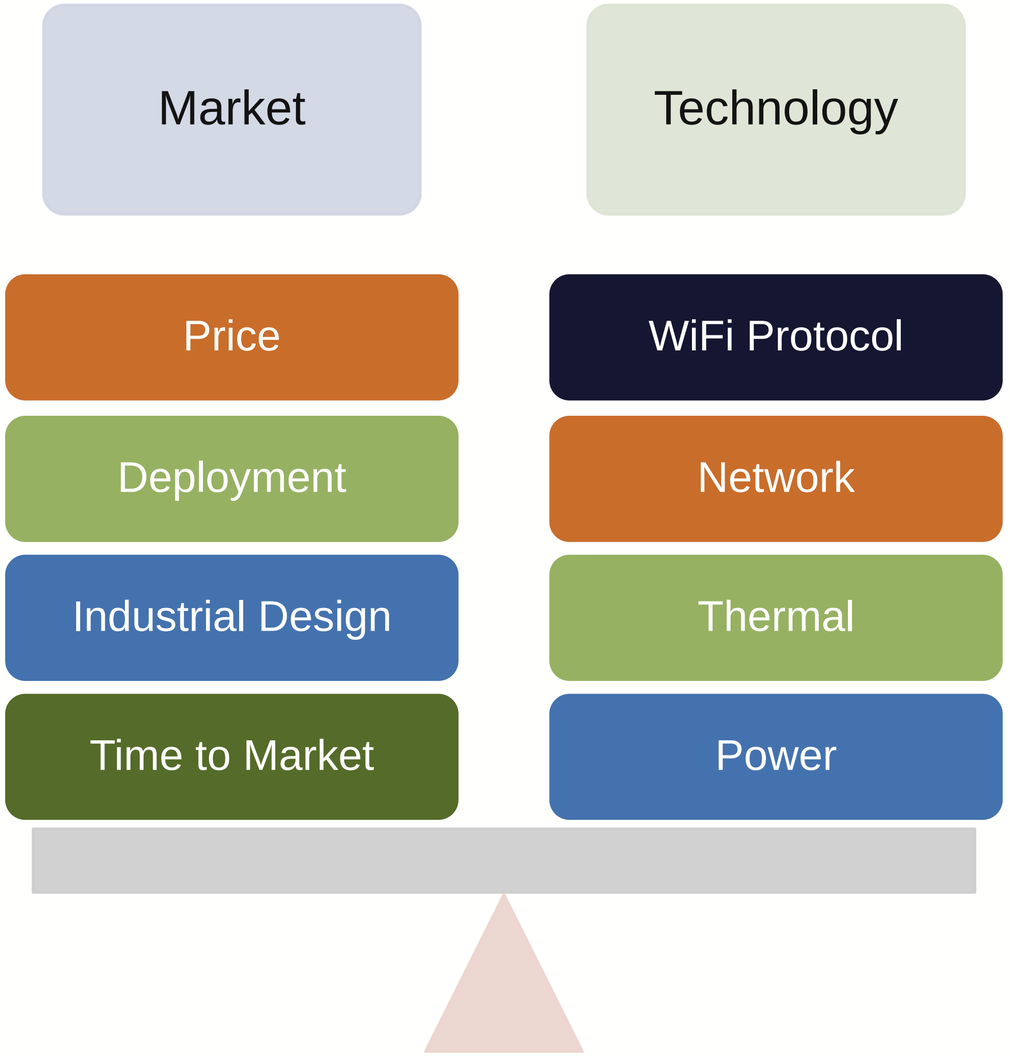
What goes into making a successful AP

A delicate balance between market and technical forces

Not a comprehensive list of things that make a difference between a successful AP and a not so successful one



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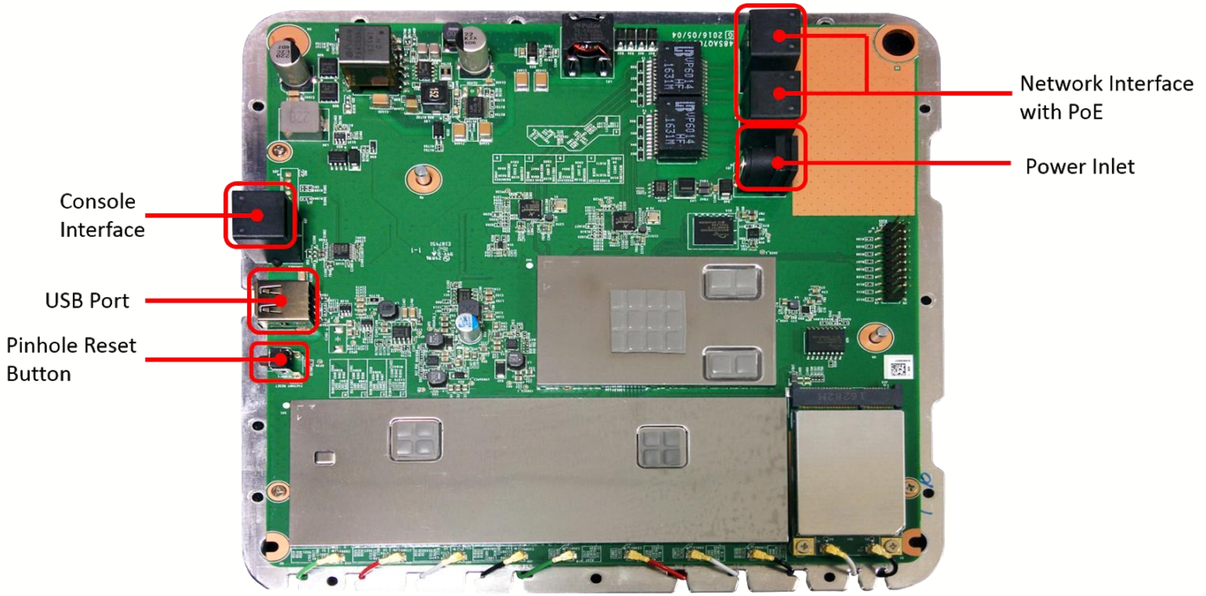
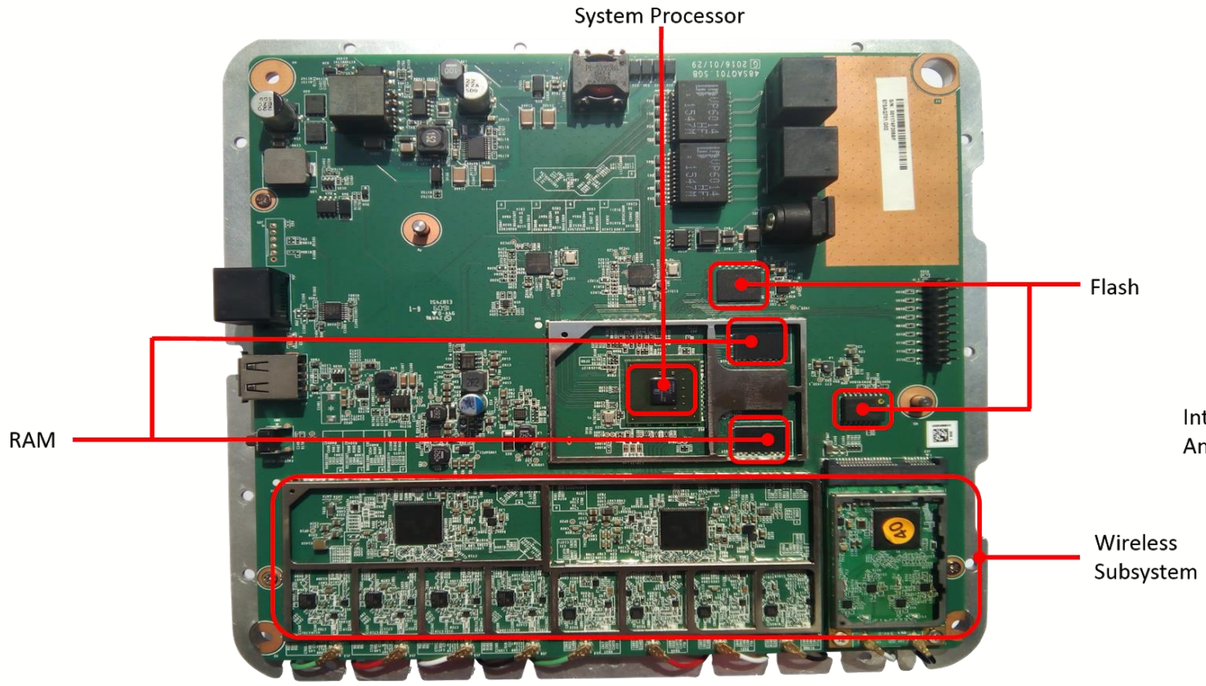
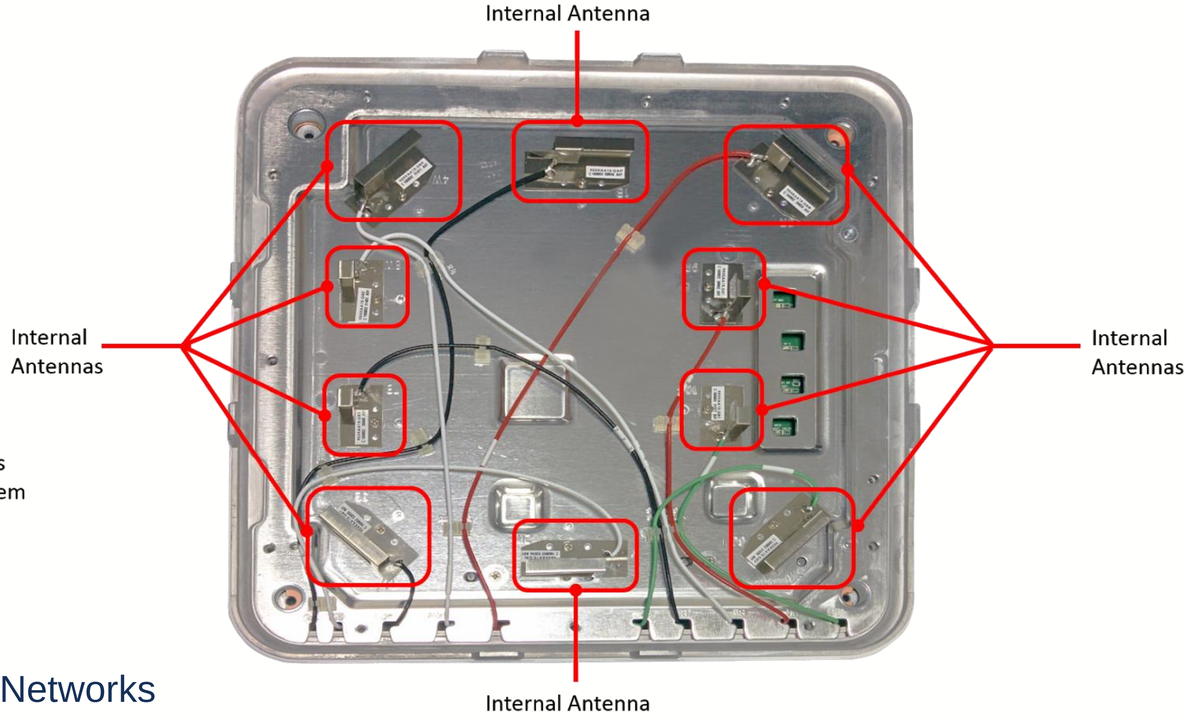
A look inside

Can be pretty intimidating when you consider all possible tradeoffs







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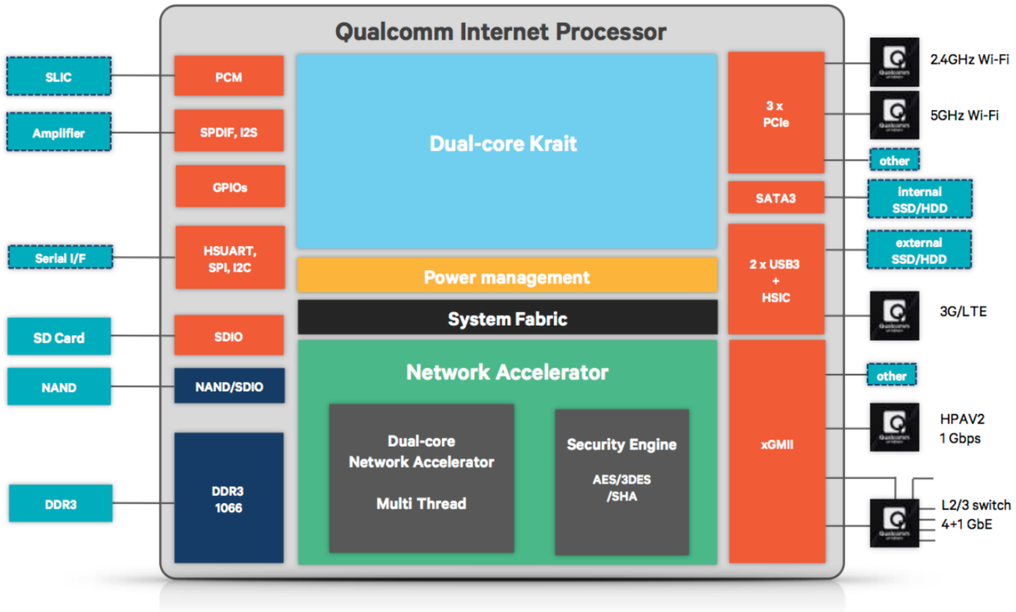
Architecture choices

Limited by what is offered by Chipset vendors

Either a processor + radio combo or fully integrated SoC

Qualcomm Acronite + Cascade



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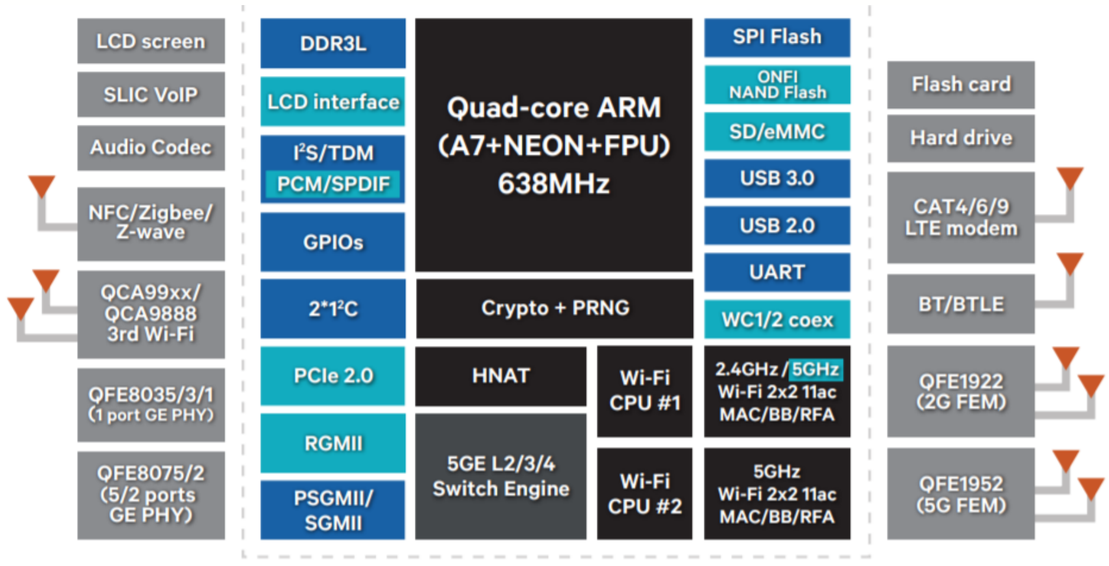
Qualcomm Dakota famly



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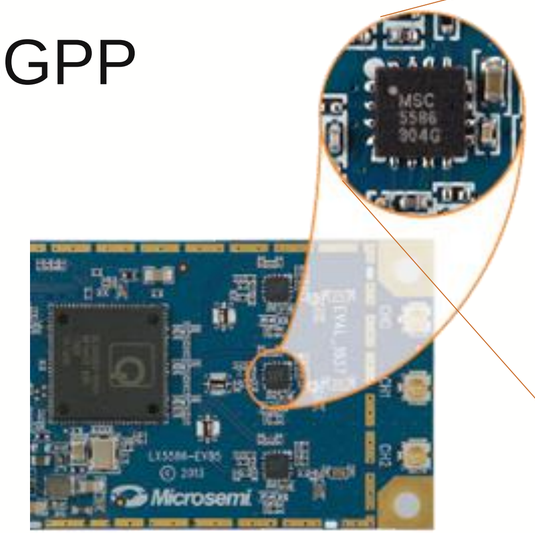
The Radio Front-end

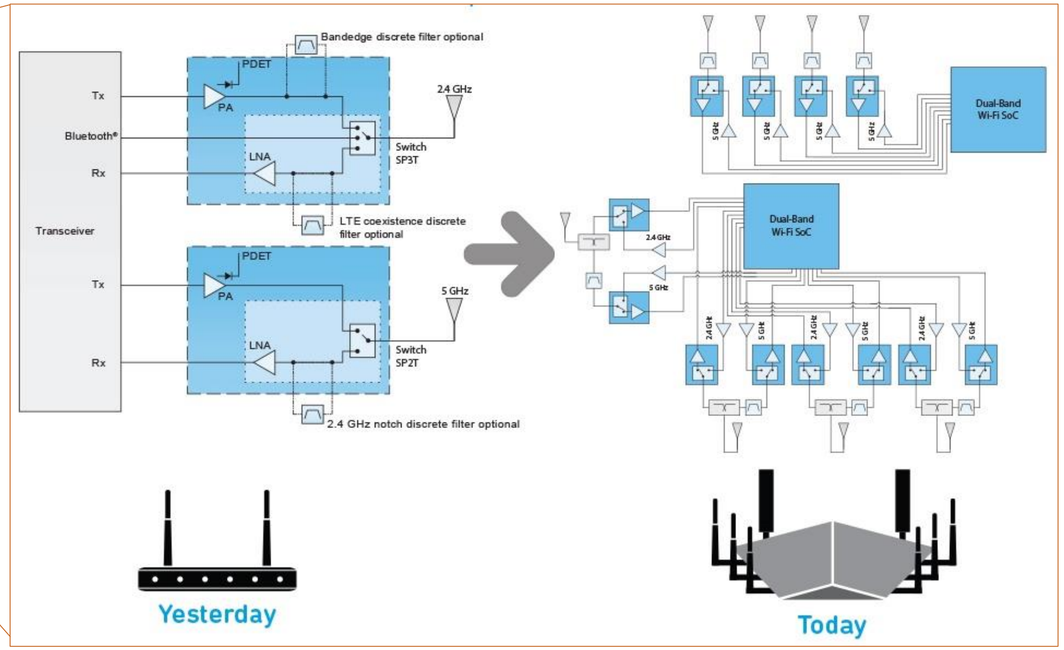
Provides a substantial differentiation

High power FEMs can provide better range but need more power and add to the cost

Interference from 3GPP

Can get pretty complex





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Power budget

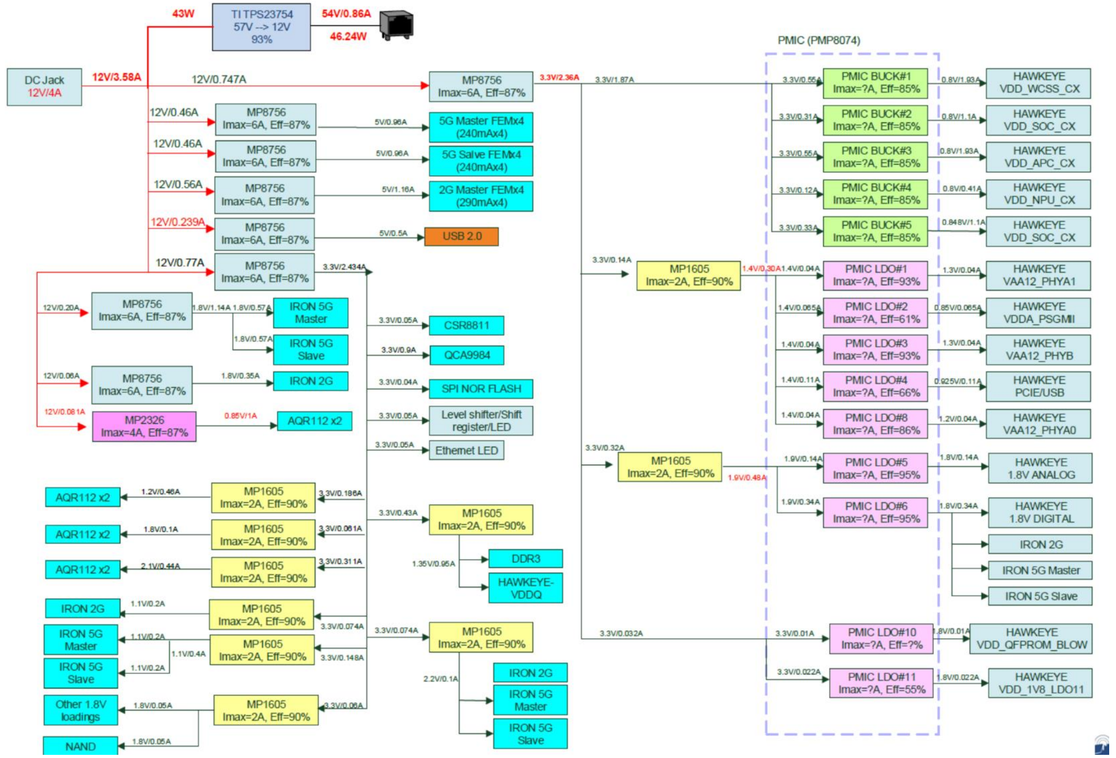
One of the most critical items to consider

- Can make or break the AP

Most enterprise APs powered by PoE

- Power is usually not available at the point of installation

A balance between APs' capabilities and power budget of switch and cabling infrastructure



Category	Standard	Data rate	Frequency	# Of cores
Cat 5	100BASE-TX	100 Mbit	100 MHz	4 or 8
Cat 5e	1000BASE-TX	1 Gbit	100 MHz Duplex	8
Cat 6	EIA/TIA 568B2.1	1 – 10 Gbit*	250 MHz	8
Cat 6A	10GBASE-T	10 Gbit	500 MHz	8
Cat 7	10GBASE-T	10 Gbit	600 MHz	8
Cat 7A	10GBASE-T	10 Gbit	1000 MHz	8
Cat 8	40GBASE-T	40 Gbit	1600 – 2000 MHz	8

Type	Standards	Max Current	Energized Pairs	Power at Device	Standard Ratified
PoE	IEEE 802.3af (802.3at Type 1)	350 mA	2	12.95W	2003
PoE+	IEEE 803.3at Type 2	600 mA	2	25.5W	2009
PoE++	Proposed IEEE 802.3bt Type 3	600 mA	4	49W	Expected 2016-2017
PoE++	Proposed IEEE 802.3bt Type 4	1000 mA	4	96W	Expected 2016-2017
Non-PoE standard-based	Cisco UPOE	600 mA	4	60W	No official ratification
Non-PoE standard-based	HDBase-T	1000 mA	4	96W	No official ratification

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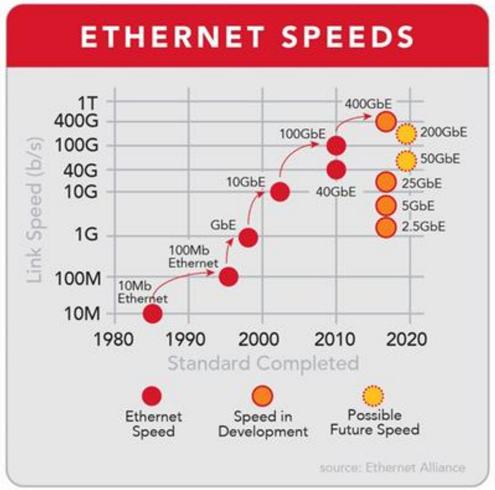
Wired side of the house

What backhaul support should be provided?

- Perception v/s reality
- Switch capabilities
- Cabling requirements
- AP cost & power consumption

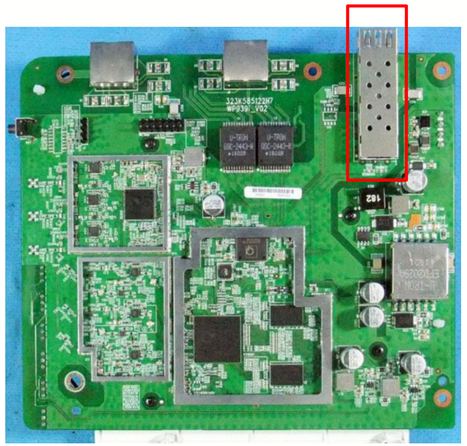


IEEE Standard	Year Adopted	Frequency	Max. Data Rate	Max. Range
802.11a	1999	5 GHz	54 Mbps	400 ft.
802.11b	1999	2.4 GHz	11 Mbps	450 ft.
802.11g	2003	2.4 GHz	54 Mbps	450 ft.
802.11n	2009	2.4/5 GHz	600 Mbps	825 ft.
802.11ac	2014	5 GHz	1 Gbps	1,000 ft.
802.11ac Wave 2	2015	5 GHz	3.47 Gbps	10 m.
802.11ad	2016	60 GHz	7 Gbps	30 ft.
802.11af	2014	2.4/5 GHz	26.7 Mbps – 568.9 Mbps (depending on channel)	1,000 m.
802.11ah	2016	2.4/5 GHz	347 Mbps	1,000 m.
802.11ax	2019 (expected)	2.4/5 GHz	10 Gbps	1,000 ft.
802.11ay	late 2019 (expected)	60 GHz	100 Gbps	300-500 m.
802.11az	2021 (expected)	60 GHz	Device tracking refresh rate 0.1-0.5 Hz	Accuracy <1m to <0.1m

1GbE was more than sufficient for 802.11ac Wave 2

802.11ax APs (even with 12 stream) will never oversubscribe a 2.5GbE port

Optical interface from the AP?



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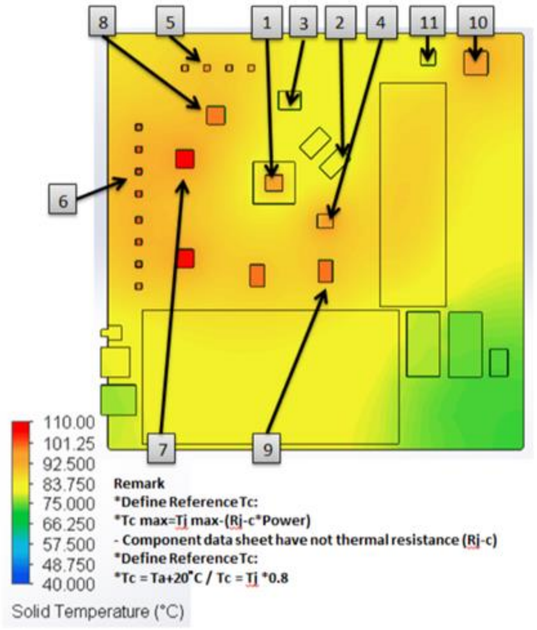
Thermal considerations

Was always an important consideration

With 802.11ax; even more so as the AP will dissipate over 40W of power

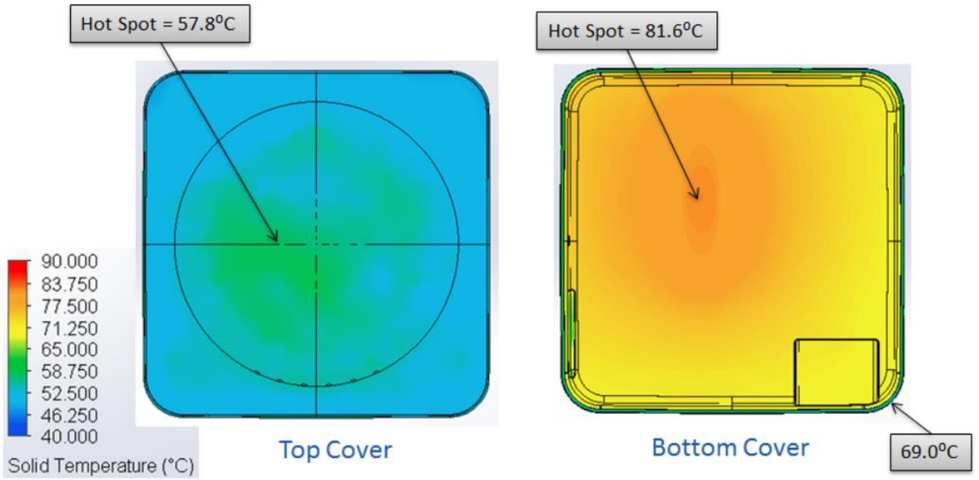
APs will hit the limits specified in the UL and EN safety specifications

11.1.1 Key components temperature



Simulation Result					
Item		SPEC. (°C)		Result (°C)	Margin(°C)
1		Tj	110	Tj	95.0	15.0
2		Tc	95	Tc	84.2	10.8
3		Tc	105	Tc	84.8	20.2
4		Tj	125	Tj	105.7	19.3
5		Tj	150	Tj	97.7	52.3
6		Tj	160	Tj	101.8	58.2
7		Tj	125	Tj	106.4	18.6
8		Tj	125	Tj	99.2	25.8
9		Tj	120	Tj	99.7	20.3
10		Tc	110	Tc	95.8	14.2
11		Tj	90	Tj	81.0	9.0

Simulation Result				
Item	Chips/ Device	SPEC. (°C)	Result (°C)	Margin(°C)
12	Top Cover	95	57.8	37.2
13	Bottom Cover	70	81.6	-11.6



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Industrial Design

Funky v/s elegant

Internal v/s external antenna

Indoor v/s outdoor

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Questions?

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