Cisco Prime

Not About

- How to do a survey
- 802.11ax
- WiFi client capacity
- Choosing antennas
- Finding interference
- Security & Encryption
- DHCP management

More about

- Visualizing coverage
- Track service areas
- Setting AP power levels
- Assigning AP channels
- RF heat maps
- Potential coverage holes

WLAN channels in North America and Europe

		2.4 GHz spectrum												
Europe	EIRP	100 mW												
USA / Canada	EIRP	125 mW												
Channel		1	2	3	4	5	6	7	8	9	10	11	12	13
Channelwidth	[MHz]	5	5	5	5	5	5	5	5	5	5	5	5	5
Frequency	[MHz]	2407					2432					2457		2472

Channel width 20 MHz [non-overlapping]: 1, 6, 11

		5 GHz spectrum																				
Europe	Primary User					ATC							TWDR / ATC			ATC						
	Requirements					only allowed with DFS / TPC																
	In-/Outdoor	only Indoor								Indoor / Outdoor												
	EIRP	max 200 mW								max 1000 mW												
USA / Canada	Primary User												TWDR / ATC									
	Requirements					only allowed with DFS																
	In-/Outdoor	Indoor / Outdoor																			Indoor / Outdoor	
	EIRP	max 200 mW								max 1000 mW											max 4000 mW	
		UNII-1				UNII-2					UNII-2 extended										Upper ISM	
Channel		36	40	44	48	52	56	60	64		100	104	108	112	116	120	124	128	132	136	140	149	153	157	161	165
Channelwidth	[MHz]	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Frenquency	[MHz]	5180				5260			5340		5500										5720	5745				5845

Main construction types at UCSC

- Poured in place concrete with steel rebar
- I-beam frame with concrete on steel deck
- Wood frame multistory bldg
- One more: can you guess?


Stevenson Casa

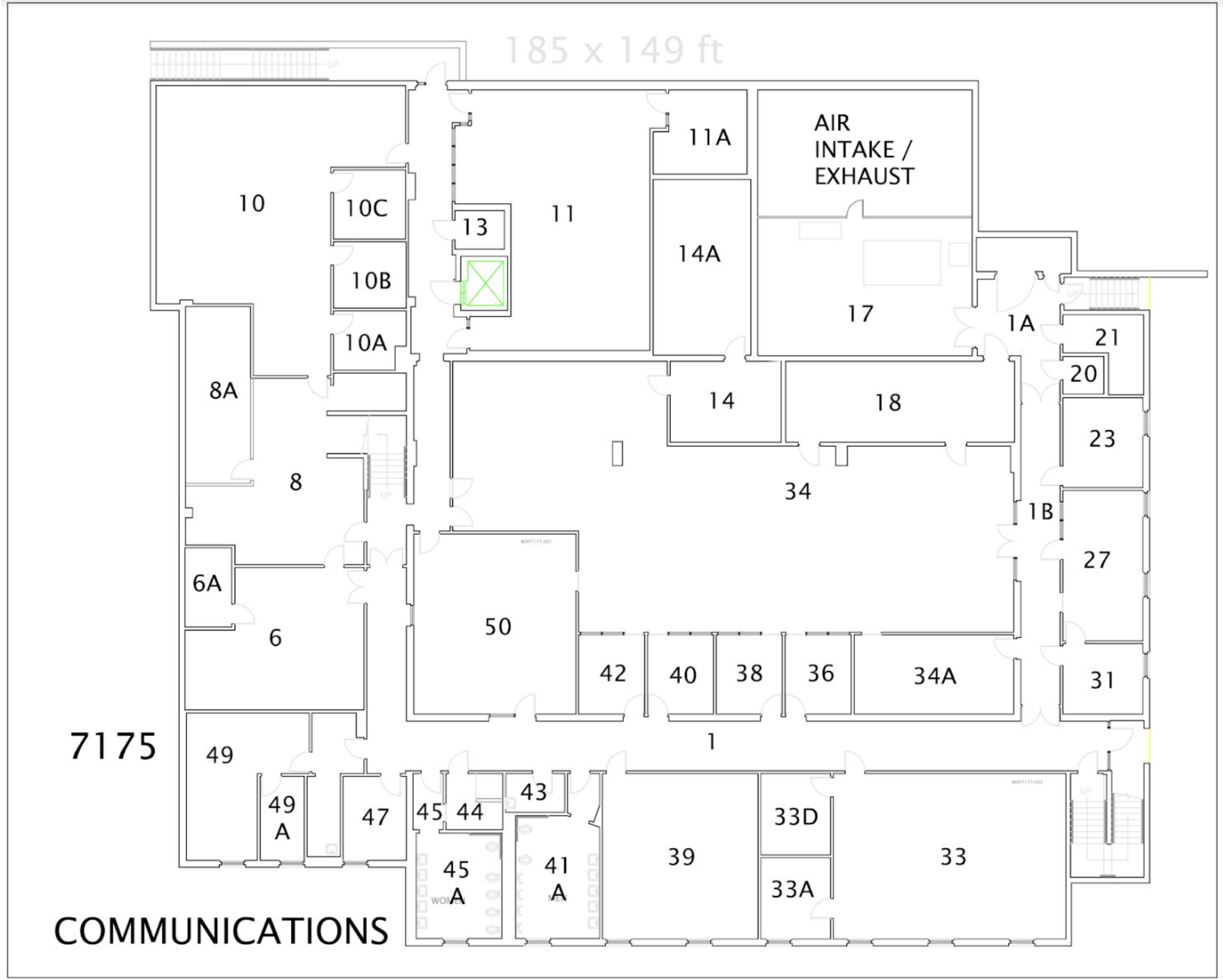

Engineering 2


Physical Sciences Bldg


Jack Baskin Eng

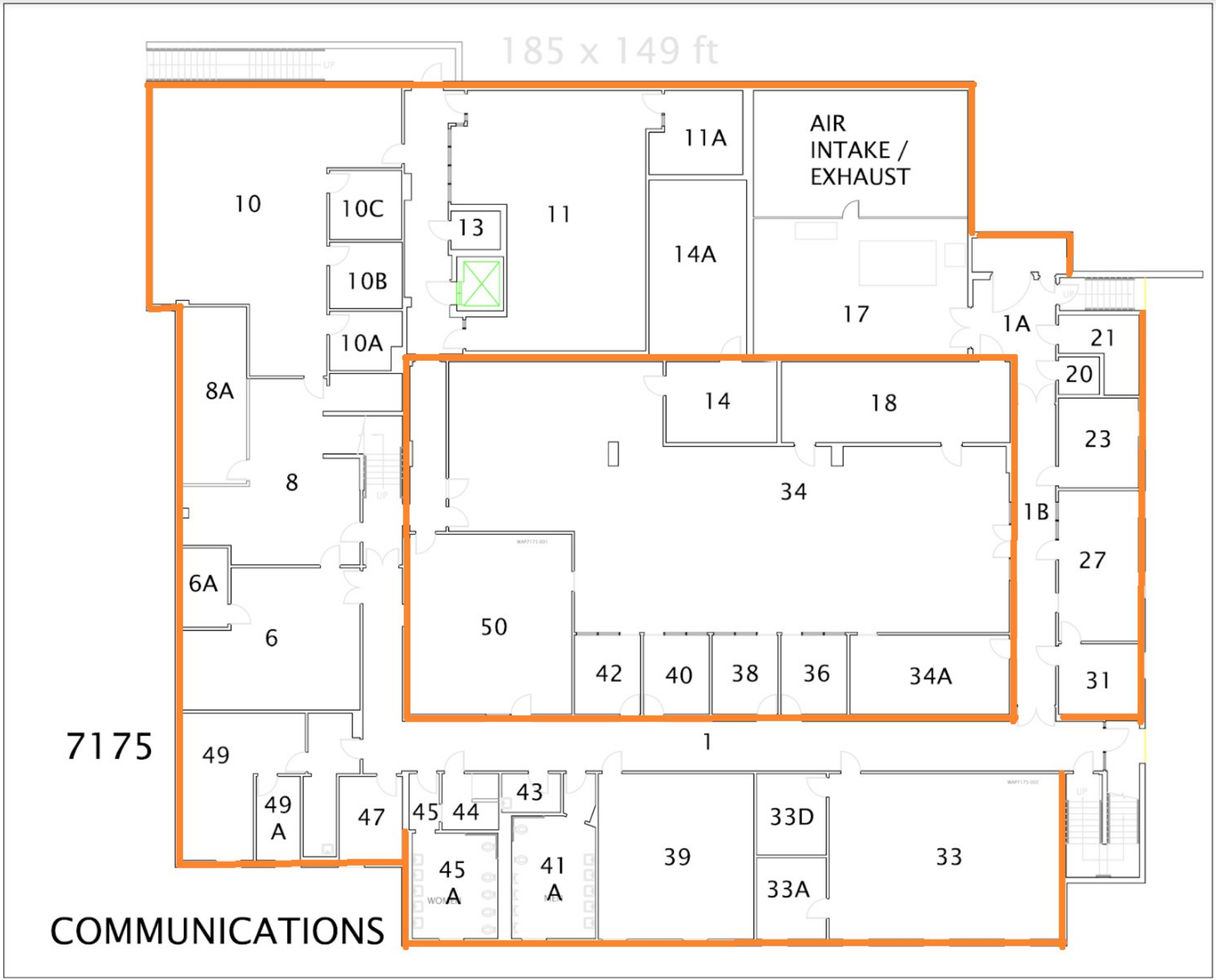
Where do floor plans come from?

- AutoCAD is good because it embeds scale factor
- http://noc.ucsc.edu/docs/howto-floor-plan.pdf
- Best source for CAD backgrounds is Facilities Link.
- Scale is very important because signal falls off with distance.
- Other drawing sources can be used, but with caution.
- Example: Comm Bldg:


185 x 149 ft
AIR
INTAKE /
EXHAUST
11A
10
10C
13
11
14A
10B
17
1A
21
10A
20
8A
14
18
23
8
34
1B
27
6A
50
6
42
40
38
36
34A
31
7175
49
1
49
A
47
45
44
43
33D
39
33
45
A
41
A
33A
COMMUNICATIONS

Important elements

- There is a bounding box around the plan
- The dimensions of the box are listed in the dwg
- You can see the walls that are thicker that are structural concrete – 12 inches thick
- Structural details are often not apparent from a plan drawing – which is why pre-installation site surveys are a good idea.
- Comm building concrete walls are ...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COMMUNICATIONS

Indoor attenuation

- Attenuation is (roughly) material blocking power.
- Some materials reflect RF while others absorb it, but that's too much of a detail for today.
- Common walls (sheet rock, plywood) have low attenuation. They are almost transparent.
- Metal completely blocks RF. Whatever gets through is leaking around the edges.
- Window glass has low attenuation unless it has a heat reflective coating.
- Concrete has a non-negligible attenuation depending on its thickness.

Annoying small buildings

- Many residential buildings are wood frame construction and not very big.
- Putting all floors of a each of these into a single *floor plan* helps avoid map clutter.
- Sharing a single floor plan makes it easier to see AP interaction through floors.
- Examples: Crown dorms, Stevenson Casas, but not Cowell dorms.
- Wood frame buildings transmit signals through floors as easily as through walls.

Radio Resource Management (protocol?)

- If all radios used the same channel only one could transmit at a time. APs need to be assigned to channels to minimize co-channel interference.
- To do channel assignment manually is impractical for networks with 60 APs in a building. Needs a computer.
- Cisco has RRM, Aruba has ARM which does a similar function. But they do not inter-operate. Hence it would be hard to call this a protocol.

Radio resource management II

- Channel assignment is not a feature of products from the shelves at Best Buy.
- You cannot build an enterprise WiFi network without cooperation between APs.
- RRM is done by the controller (WLC) and not by CPI. CPI maps can show you how the WLC has done its work. See this in the demo.
- But wait, there is more . . .

RRM III

- The way to increase the *capacity* of the network is to increase the number of cells. So cells need to shrink. Cellular phone nets do this, too.
- RRM does this by reducing the transmit power of APs
- Cisco APs can run at power levels of 100 mW, 50 mW, 25 mW, 12 mW, 6 mW, 3 mW, 1.5 mW and 0.75 mW. Xmit power can be viewed in CPI
- Rogue APs intended for the home market always run at full power.

RRM IV

- Some engineers believe they can do a better job assigning channels manually.
- Some engineers claim to have suffered great pain from RRM and they don't trust it.
- Some engineers believe that RRM makes some assumptions about AP placement that will make it work properly. For example, 8 APs in a line down a straight hallway will cause RRM to do the wrong thing. Ekahau has explained this.

Heat Maps

- Heat maps show spatial signal strength from the best AP laid on top of a floor plan.
- Unlike RRM, heat maps are calculated by CPI. Warning: garbage in, garbage out.

Live Demo

- Only fools do a live demo in front of an audience
- New vs Old maps [new is better]
- Looking at AP names
- Looking at clients per AP
- Looking at channel assignments, xmit power
- Looking for co-channel interference
- RFdistance between APs
- Potential coverage holes from heat maps
- RF obstructions inside structures