



Least Congested Channel Recommendation for Uncoordinated Access Point

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1



Overview

Why is the network slow?

Why is this website not loaded properly?

My wifi is full bar. Why do I still suffer network problem?

I am Steve Jobs™. I ain't got time for petty network problems.

WHAT IF I TOLD YOU THAT



YOUR WIFI SUCKS. CHANGE THE CHANNEL.



How to find the **best channel** for
your **wireless access point(WAP)**
for **better network performance?**



Previous works

Previous works

- ▶ M. Achanta, Method and Apparatus for Least Congested Channel Scan for Wireless Access Points, US Patent No. 20060072602, April, 2006.
- ▶ Shugo Kajita et al., A Channel Selection Strategy for WLAN in Urban Areas by Regression Analysis, 10th IEEE International Conference on Wireless and Mobile Computing, Networking and Communications, Cyprus, p.p. 642 – 647, 8-10 October, 2014.
- ▶ Neema Abraham et al., Adaptive Channel Allocation Algorithm for WiFi Networks, International Conference on Circuit, Power and Computing Technologies, India, p.p. 1307 – 1311, 20-21 March, 2014.
- ▶ A. Mishra et al., Weighted Coloring Based Channel Assignment for WLANs, ACM SIGMOBILE Mobile Computing Communication Revision, vol. 9, no. 3, pp. 19–31, 2005.



Approach

Approach

- ▶ Rate each channel with a scoring system.
- ▶ The channel with the highest score is deemed the best channel.
- ▶ Same of the fixed value such as weightage are subject to change.

Channel	Score
1	3.534
2	3.172
3	3.172
4	3.348
5	3.223
6	4.573
7	3.348
8	3.298
9	3.222
10	2.197
11	1.666

Highest score.
Best channel

Example channel
score for 2.4GHz



Steps

- ▶ Do Wi-Fi scan
- ▶ For each channel (score calculation)
 - Calculate score for each **parameter**
 - Multiply score of each parameter with each parameter's **weightage**
 - **Accumulate** each parameters score
- ▶ The channel with the highest score is the best channel



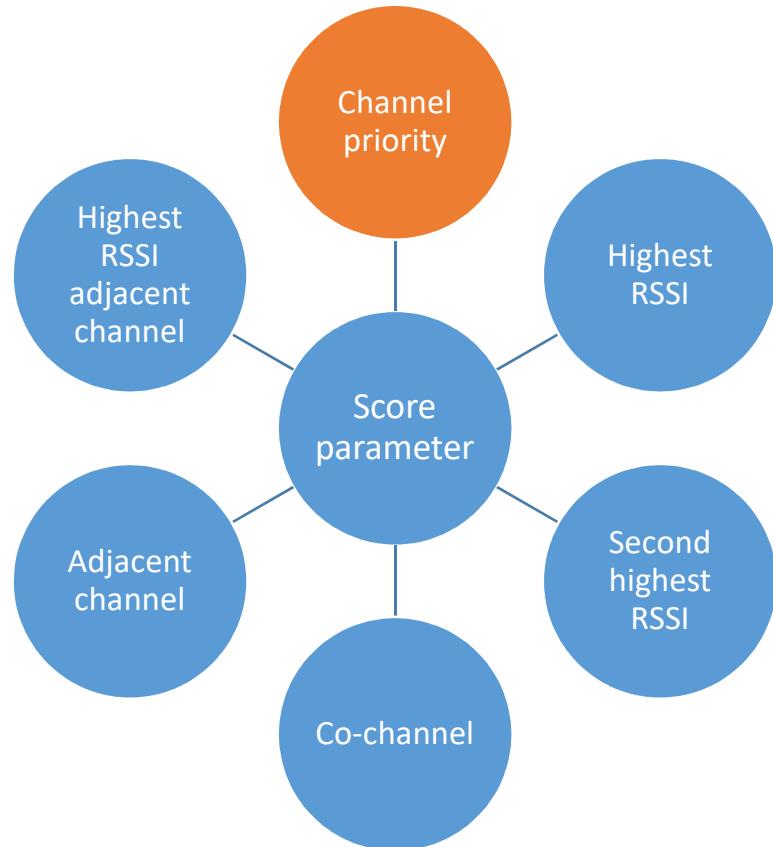
Scoring method



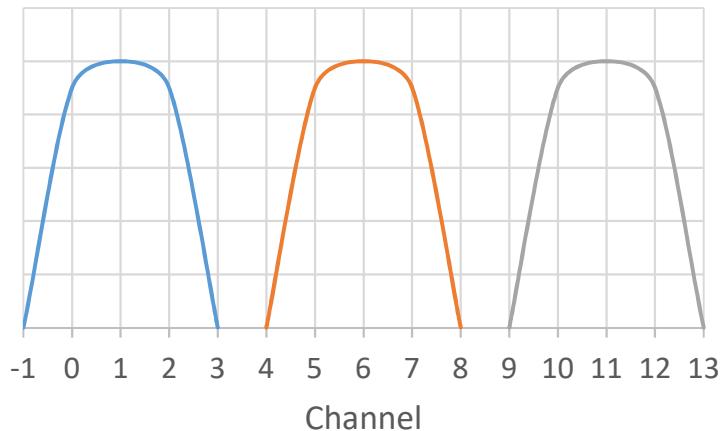
Parameter	Score	Weightage	Final score
Channel priority	10	0.15	1.5
Highest RSSI	0.018	0.2	0.004
Second highest RSSI	0.012	0.15	0.002
Co-Channel	0.2	0.2	0.04
Adjacent channel	1	0.15	1
Highest RSSI adjacent channel	1	0.15	1
Total score			3.534

Example score calculation for a channel

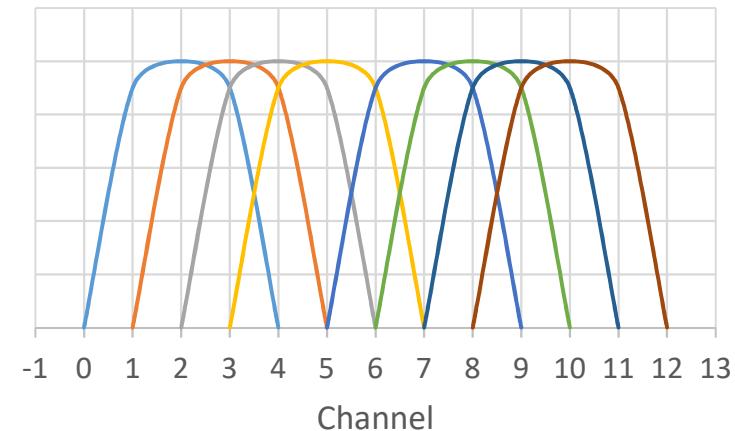




Channel priority



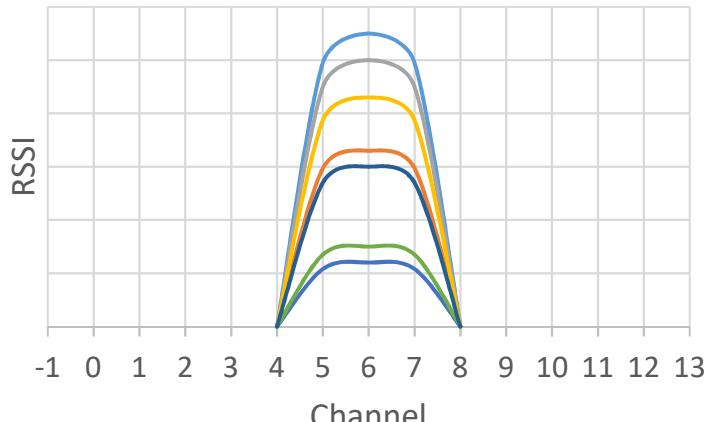
Non overlapping channels for 2.4GHz.
Channel 1, 6, 11. **Score = 10.**



Overlapping channels for 2.4GHz. Channel
2,3,4,5,7,8,9,10. **Score = 1.**



Highest RSSI



Multiple WAP shares the same channel 6.

1. Get *the highest RSSI* for the channel.
2. E.g. *the highest RSSI* is -56
3. Let *the highest RSSI* be the denominator of a unit fraction.

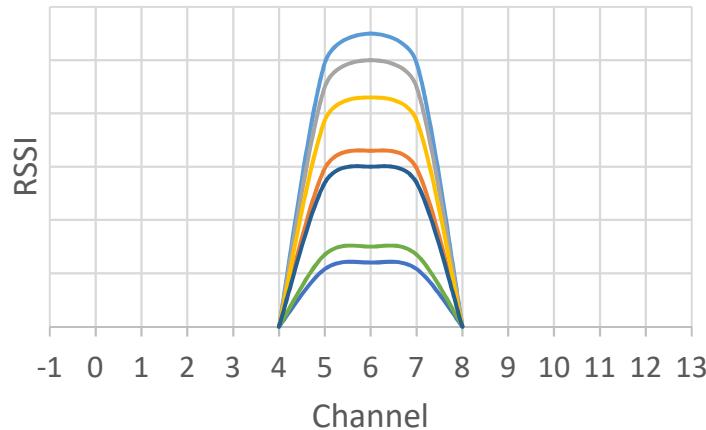
$$\frac{1}{-56} = -0.018$$

4. Highest RSSI score = -0.018
5. If there are no WAP using the channel, final score = 1





Second highest RSSI



Multiple WAP shares the same channel 6.

1. Get *the second highest RSSI* for the channel.
2. E.g. *the second highest RSSI* is -78
3. Let *the second highest RSSI* be the denominator of a unit fraction.

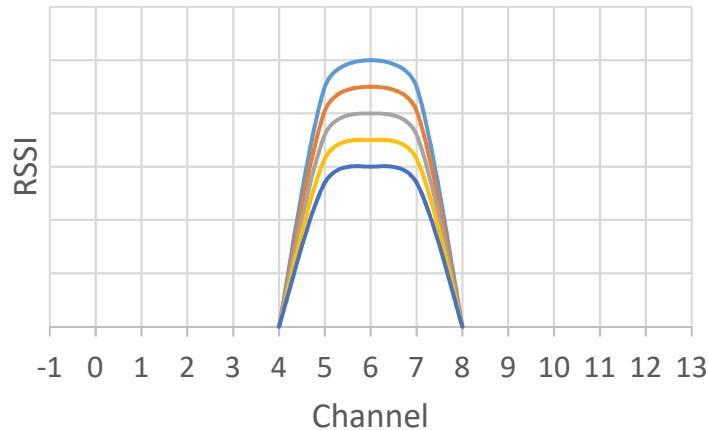
$$\frac{1}{-78} = -0.013$$

4. Highest RSSI score = -0.013
5. If there are no WAP using the channel, final score = 1





Co-Channel



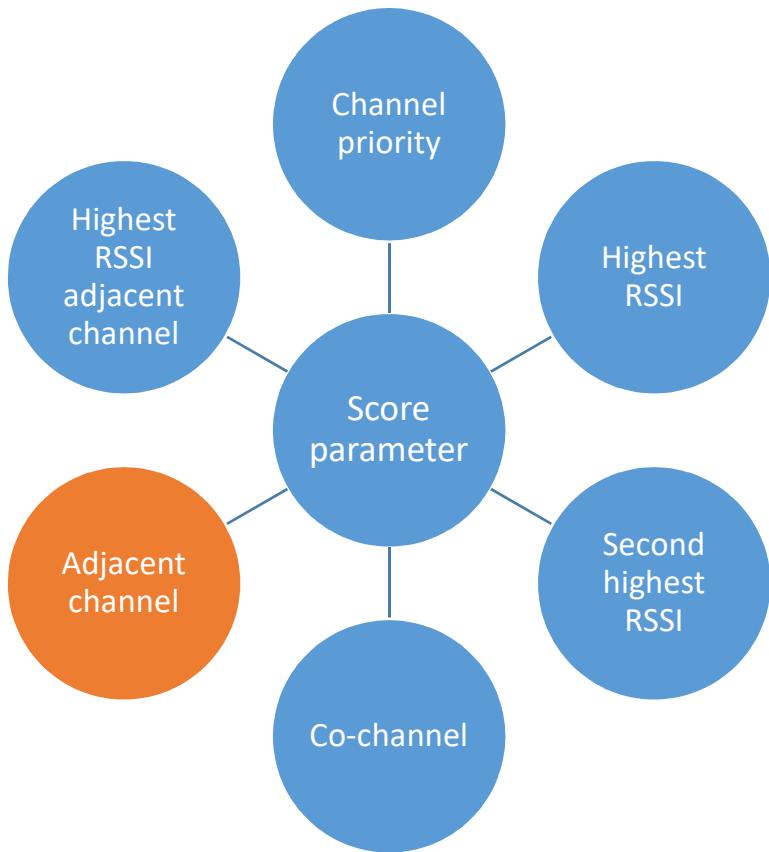
Channel 6 have 5 co-channel.

1. Get the *total co-channel* for the channel.
2. E.g. there are 5 WAP that uses channel 6.
3. Let *total co-channel* be the denominator of a unit fraction

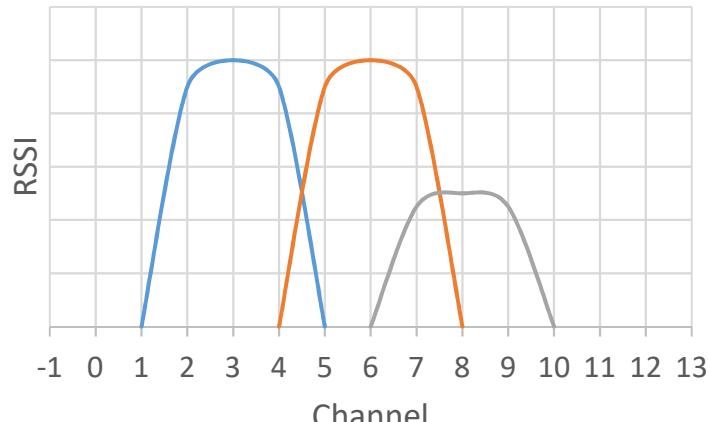
$$\frac{1}{5} = 0.2$$

4. Co-Channel score = 0.2
5. If there are no co-channel, final score = 1





Adjacent channel



Channel 6 have 2 adjacent channel.

1. Get the *total WAP using channels that interferes with current channel*.
2. E.g. there are 2 WAP that uses channels that interferes with channel 6.
3. Let *total adjacent channel* be a denominator of a unit fraction.

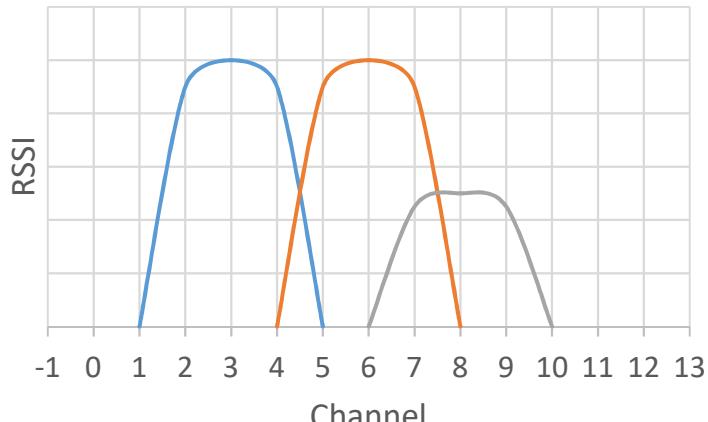
$$\frac{1}{2} = 0.5$$

4. Adjacent channel score = 0.5
5. If there are no adjacent channels, final score = 1





Highest RSSI adjacent channel



Channel 6 have 2 adjacent channel.

1. Get the *highest RSSI among adjacent channel* for the channel.
2. E.g. the highest RSSI between the 2 adjacent channels is -56.
3. Let *highest RSSI among adjacent channel* be a denominator of a unit fraction.

$$\frac{1}{-56} = -0.018$$

4. Adjacent channel score = -0.018
5. If there are no adjacent channels, final score = 1





Parameter	Weightage
Channel priority	0.15
Highest RSSI	0.2
Second highest RSSI	0.15
Co-Channel	0.2
Adjacent channel	0.15
Highest RSSI adjacent channel	0.15

Example parameter weightage.



Parameter	Score	Weightage	Final score
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Example score calculation for a channel.



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Highest score.
Best channel



Test

Test setup

- ▶ 10 RGs.
- ▶ Set auto channel selection.
- ▶ Create a situation where the best channel is obviously a certain channel (e.g. channel 6).



Model	Brand	Channel after reboot					
		1st	2nd	3rd	4th	5th	6th
RG1	MAC1	4	3	3	3	4	3
RG2	MAC2	2	1	1	2	1	2
RG3	MAC3	3	2	3	2	2	3
RG4	MAC4	1	1	5	1	9	1
RG5	MAC4	8	8	8	7	8	8
RG6	MAC3	11	6	11	11	6	11
RG7	MAC3	6	6	11	9	6	11
RG8	MAC4	13	6	6	13	6	6
RG9	MAC4	10	10	1	1	9	1
RG10	MAC3	7	9	11	4	4	6

Test summary

- ▶ All RG we tested choose channel either by
 - Random
 - Random between non-overlapping channel
 - Random between limited set of channel



Conclusion

- ▶ Simple algorithm for improve network performance
- ▶ Simple scoring approach that is simple to enhance, add new features/parameters
- ▶ Can be use on 2.4GHz, 5GHz and possibly future wireless standard
- ▶ Practical for telco to implement
- ▶ We have develop on multiple platform (Windows browser, Win10, IOS, Android)
- ▶ Areas open for research
 - Parameter weightage
 - Scoring parameters



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► Material repository

- <https://github.com/syaifulnizamyahya/icact2017>

The end.

Questions?