Optimal channel allocation for wireless cities

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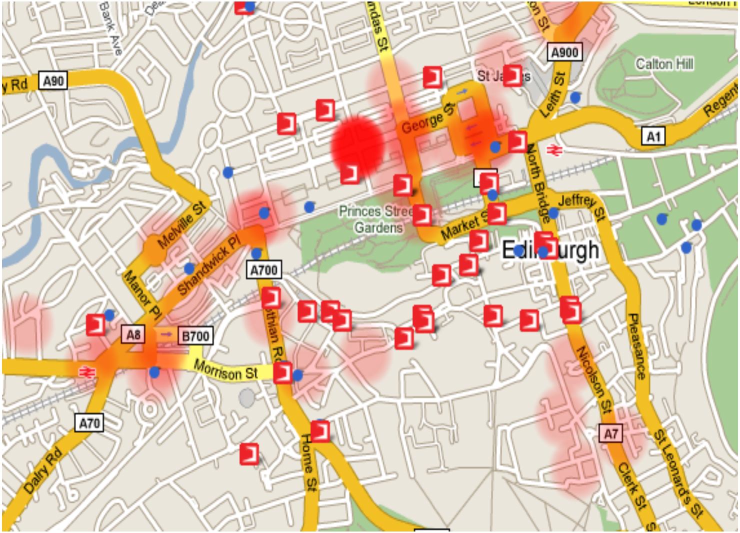
A90
Bank Ave
A900
Calton Hill
St James
Leith St
George St
A1
Regent
North Bridge
Jeffrey St
Princes Street Gardens
Market St
Edinburgh
Melville St
Shandwick Pl
Manor Pl
A700
A8
B700
Morrison St
Lothian Rd
Home St
A70
Dalry Rd
Nicolson St
Pleasance
A7
St Leonard's St
Clerk St

802.11b spectral characteristics

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- vector of overlap factors: $[0, -2.767, -11.329, -28.525, -45.296, -61.560, -74.686, \ldots$

802.11b interference

- the *interference at node j caused by node i* is $I_{ij} = r_{ij} + c(|x_i - x_j|)$ where $r_{ij} = T_j - (P_{\text{ref}} + 10m \log_{10}(d_{ij}))$ dBm is the received power at node i from node j.

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- d_{ij} is the distance from node i to node j
- T_j is the transmit power, typically 20dBm (100mW)
- P_{ref} is the reference loss at 1m, typically 40.2dB
- m is the path loss exponent, typically about 2.86

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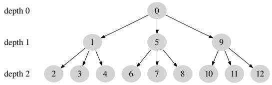
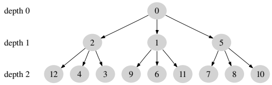
Local best-first search

- Branch-and-bound
  - Exact and enumerative method
- Combination depth-first and best-first
  - Depth-first: find feasible solution fast
  - Best-first: find best solution fast

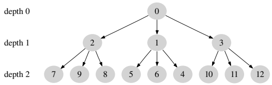
Depth-first search



Best-first search

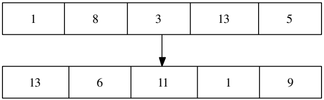


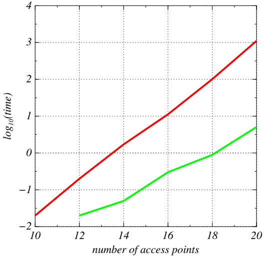
Local best-first search



Speed-up tricks [1]

- Complementary solutions
  - Symmetric channels
  - Omit similar assignments
- Channel spacing
  - Reduce channel overlap and number of channels
  - Reduce complexity
- Pre-ordering
  - Critical access points first





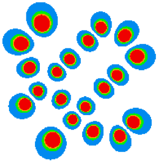
Speed-up tricks [2]

- Initial random solution
  - Find a good upper bound for pruning
- Incremental objectives
  - Reduce time complexity
  - Only applicable on certain objectives
- Symmetric AP distance matrix
  - If measuring point is at AP
  - Transmit power is left out

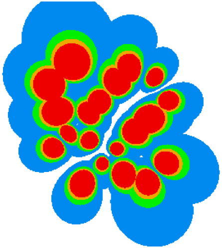
Results [1]

Comparison of the throughput area

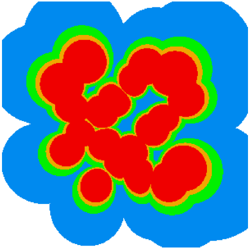
Modulation schemes: 11Mbps, 5.5Mbps, 2Mbps, 1Mbps



(a) 20 APs using the same power level and channel



(b) 20 APs with randomly assigned channels

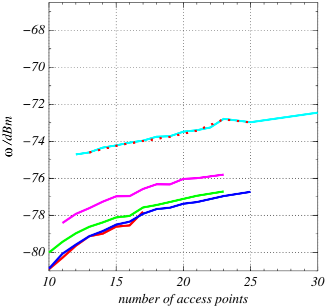


(c) 20 APs using the same power level, but with an optimized channel allocation (13 channels)

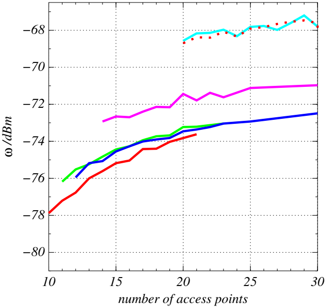
Results [2]

Comparison of two objectives

Channel spacings: 1 (red), 2 (green), 3 (blue), 4 (magenta), 5 (cyan), 6 (dotted red)



Minimizing the average interference



Minimizing the maximum interference