Fixing 802.11 Access Point Selection
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Current 802.11 access point selection is broken

Current model
Currently mobile hosts select the AP with the best signal-to-noise ratio. The standard does not require this, but the lack of standard support for other mechanisms makes selection via SNR the only viable policy.

Real-life example of why this is bad
A cell in CMU’s business school covering two large lecture halls was routinely overloaded. To alleviate this problem, network administrators installed an additional access point, on a free channel, to cover this area.

Evaluation Obstacles:
Implementation – AP selection implemented in firmware
Deployment – Difficult to evaluate alternative algorithms on a large scale in a real network

Results: Adding an additional access point didn’t help!

The source of the problem: Poor access point selection
SNR measurements plotted on two copies of the building floorplan. Larger circle = better SNR.

Gathered extensive signal samples throughout GSIA.

Models evaluated
SNR only – Select AP with the best SNR regardless of load or number of users.
Load Sensitive – Consider both SNR and AP load. Select AP that appears to offer the best available bandwidth. Use hysteresis and randomization to avoid oscillation.

AP Load Sharing Performance
SNR only access point selection puts the entire load onto GSIA-160 while load sensitive AP selection divides the load between the two access points.

For many flows, Load Sensitive AP selection provides significantly better performance.

Preliminary Results

Evaluation of alternative models

Idea:
Evaluate load sensitive access point selection using a simulation of 802.11 infrastructure mode; take into account as many real-world factors as possible.

Traffic Traces – All flows exiting the wireless network are logged using Argus.

User Location Traces – “Synthetic traces” of user movement generated from cell population traces.

Cell Population Traces
Signal Strength & Building Map
Room Density Table

Synthetic User Location Traces

Excerpt of GSIA map showing signal samples
Using the above tools, for any given sample location we have good estimates of the SNR from all available access points. For determining interference between stations we use a signal propagation model based on the data obtained.

Simulation Engine
User Location Traces
Traffic Traces

End user throughput results of GSIA-160

Throughput: Obtained / Desired
For many flows, Load Sensitive AP selection provides significantly better performance.

The single access point is unable to cope with the large bandwidth requirements of the “busy period” shown.