



Rio de Janeiro
2010

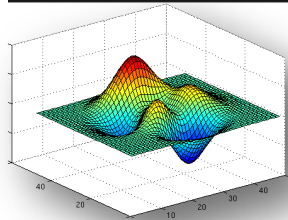
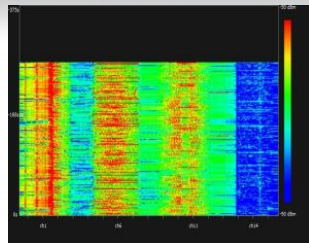
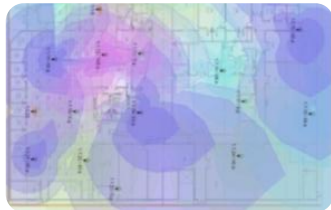
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Controlling the Air

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Challenges in wireless



Varying capacity channels

- Wireless capacity is not fixed even in clean environments

Dynamic RF Environments

- Typical RF environment is constantly changing

RF Interference

- Many interfering devices on both bands

Channel/spectrum availability

- Availability depends on many factors

Client behavior

- Mixed clients with varying behavior

Many of these are inter-related



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Varying capacity channels

Capacity is fixed in typical wired networks

- 10/100/1000/10000 Ethernet
- The available capacity is usually a percentage of the maximum when all clients are of the same type

Wireless capacity varies based on a variety of factors

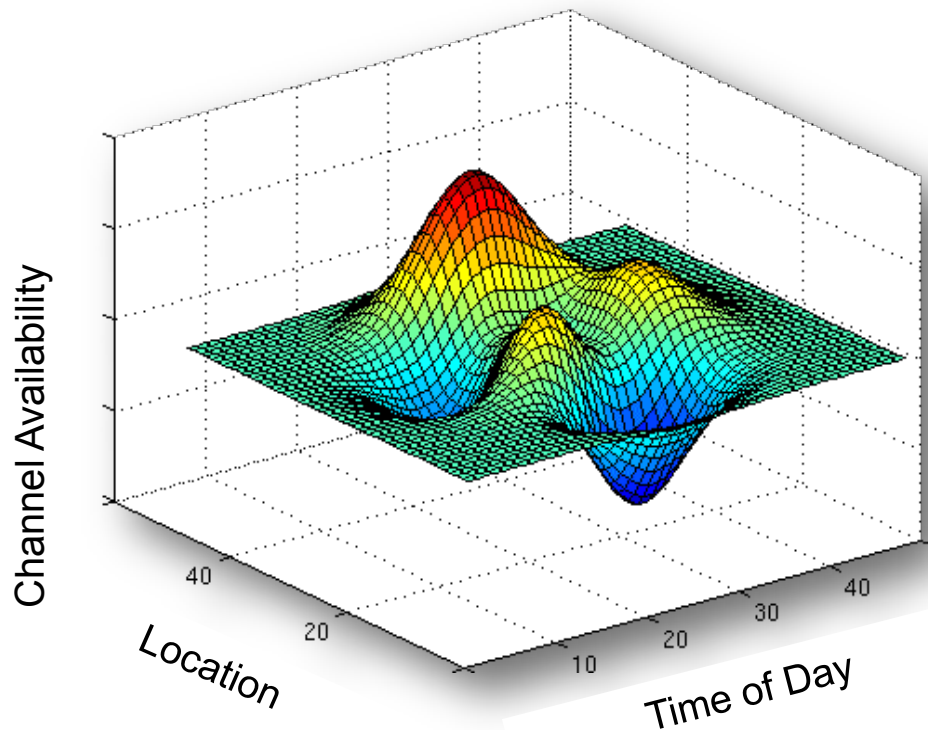
- Distance between the AP and clients
- Adjacent and co-channel interference
 - Number of APs/clients in the network (e.g., contention)
- Capability and behavior of clients (e.g., rate control)
- RF environment and other sources of interference

Unfair access if there is no airtime management

- Slower clients and faster clients need to be managed
- Airtime needs to be fairly allocated



Dynamic RF Environment



Location

- Location of the AP/client
- Mobility of devices

Time of day

- Changes in network usage
- Changes in number of devices
- Interference sources (e.g. Microwave)

Changes in environment

- Metal doors or other moving objects
- Outdoor deployment issues

Needs active management

- Monitor, measure and take corrective steps



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RF Interference

2.4 GHz and 5 GHz Interferers

- Video bridges, wireless video surveillance, wireless cameras
- Cordless phones and headsets
- Baby monitors and similar audio/video devices

2.4 GHz Interferers

- Microwave, Bluetooth and wireless microphones

5 GHz Interferers

- Radars
- Certain types of motion sensors

Effect of Interference

- Some interferers make the entire channel unusable
- Some interferers severely degrade performance
- Connectivity and capacity problems

Interference management

- Detection and avoidance



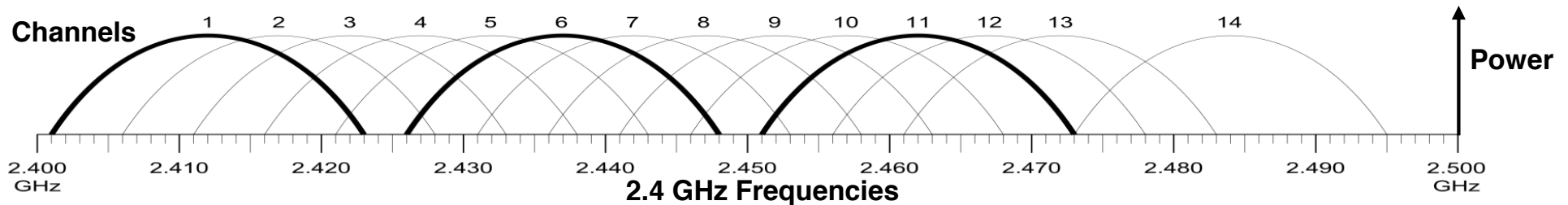
Channel Availability

2.4 GHz

- 3 non-overlapping 20 MHz channels (4 in Japan)
- Only one non-overlapping 40 MHz channel
- Many non-802.11 devices use this band

5 GHz

- Significantly more channels (up to 24 for 20 MHz and 11 for 40 MHz)
- Radar and DFS regulatory restrictions
- Indoor/outdoor restrictions
- More non-802.11 devices are becoming available in this band



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Client behavior

Sticky clients

- Some clients stick to the AP until it's too late
- Also brings down the overall capacity due to lower rates used

2.4 GHz vs. 5 GHz

- Many clients are dual-band
- Most clients cannot decide the best band to connect

Network visibility

- Clients do not have full visibility into the network
- May connect to an overloaded AP while a lightly loaded one is available

Miscellaneous issues

- Bugs or driver versions, not following the standard, etc



Aruba Solutions

Goals

- Continuously monitor, measure and automatically take corrective actions for the best user experience
- Provide summarized and useful information to the users
- Best tools for isolating and debugging problems

Spectrum Analysis

- Charts and metrics to visualize spectrum and isolate issues
- Spectrum information from CLI
- Interferer classification

Adaptive Radio Management (ARM)

- Automatic channel and power assignment
- Airtime fairness
- Band steering and Spectrum load balancing
- Noise-awareness

Airwave Management Platform (AMP)

- Visibility at the per-user and per-channel level



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