# Mobilité transparente dans les réseaux sans fil IEEE 802.11

María Eugenia Berezin
Laboratoire d'Informatique de Grenoble
*berezin@imag.fr*

*Journées scientifiques SEmba 2010*

19 octobre 2010

# IEEE 802.11: Wireless Local Area Networks (WLANs)

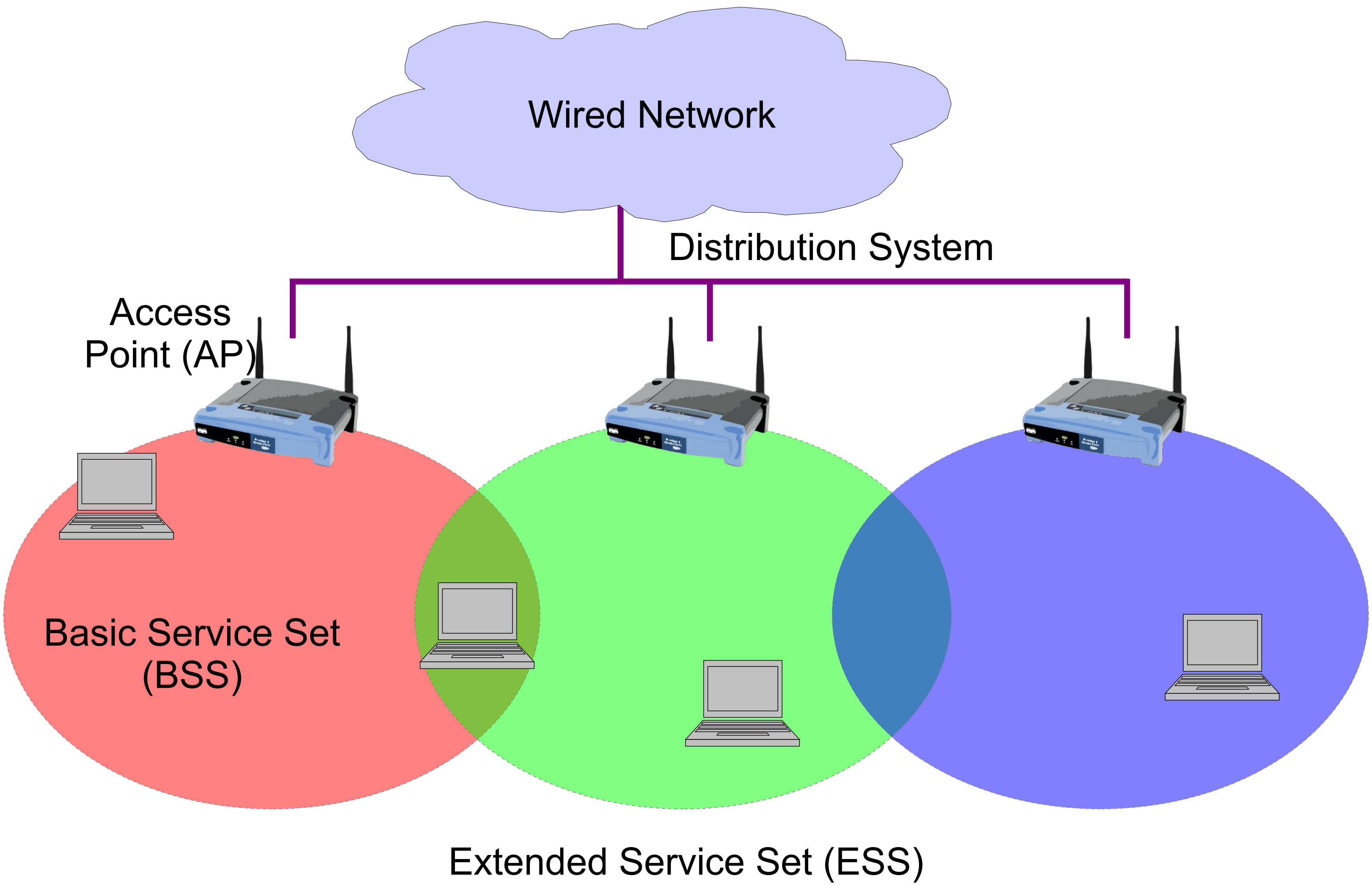
- Flexibility / Low Cost
- Mobility
- Extension of Wired Networks
- High bandwidth → Use of real-time applications:
  - Delay constraints
  - Mobility can interrupt communications

# Summary

- Mobility in WLANs
- Handoff process
- Multichannel Virtual Access Points
- Conclusions and Future Work

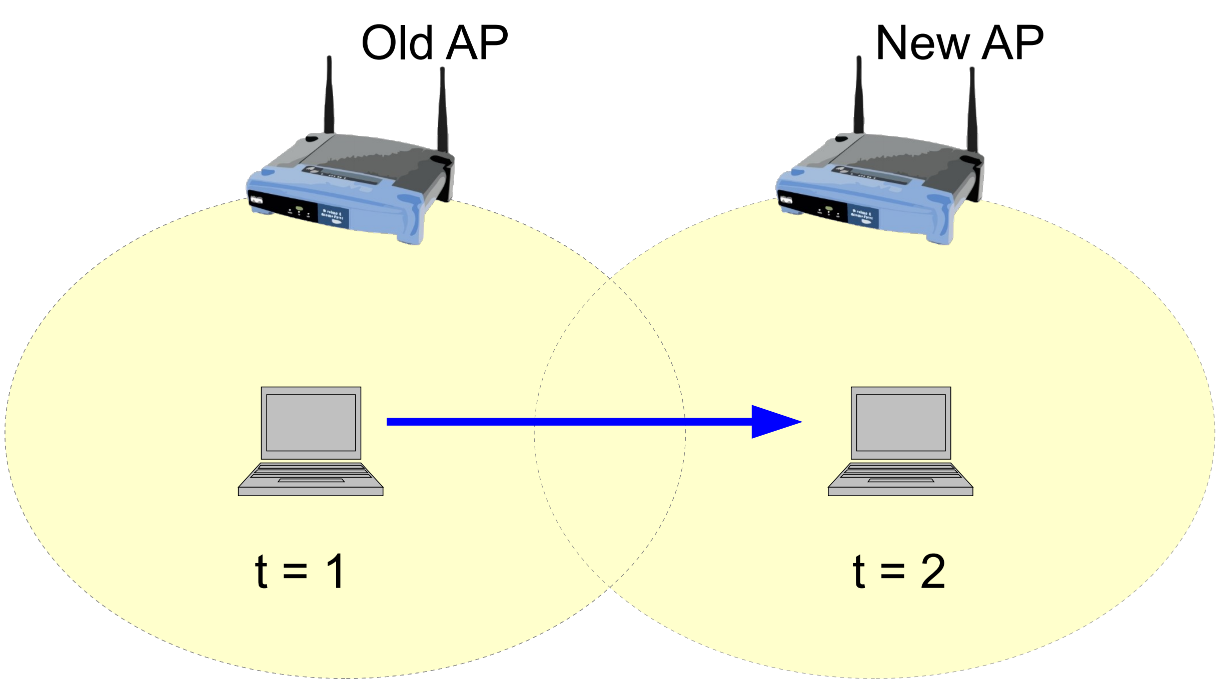
# The background:
# Mobility in WLANs

# WLANs Architecture



# Mobility in WLANs

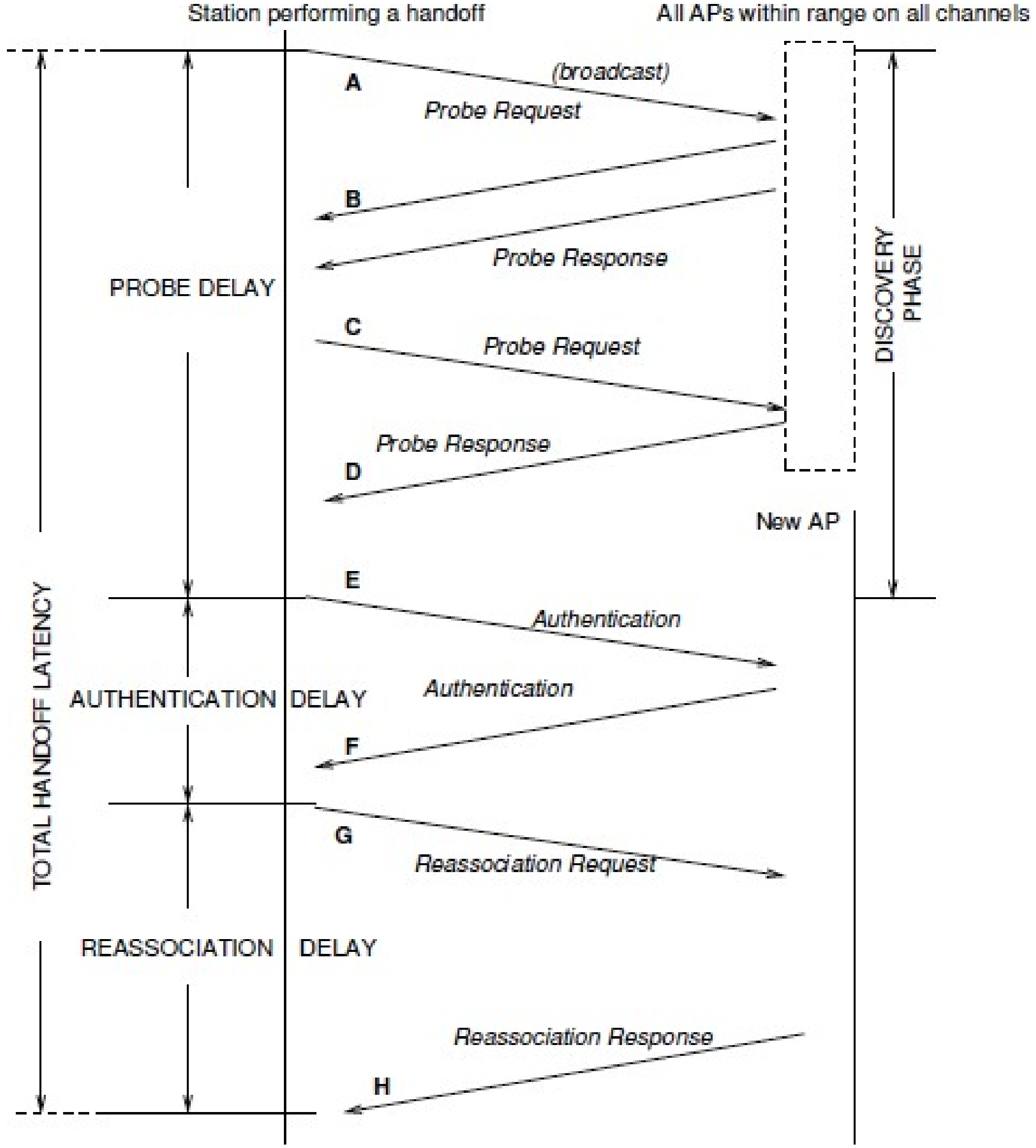
- BSS Transition: MAC layer mobility
- Requires cooperation between APs
- Handoff process



# The problem:
# Handoff process

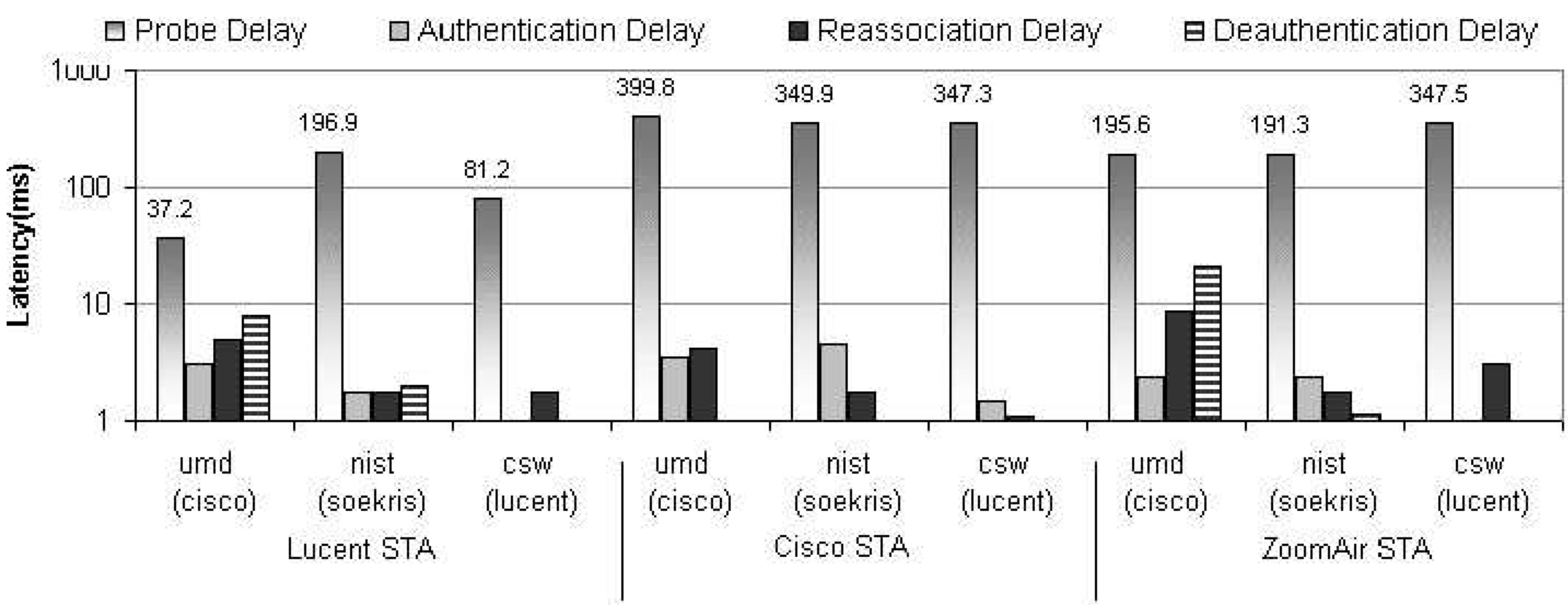
# Handoff

- Probe Request / Probe Response
- Authentication
- Association



# Handoff Delay

- Observed delays: 200-1000 ms *(Mishra et al.)*
- Mostly in scanning
- Constraints:
  - VoIP: 150 ms



# Handoff: Related Work

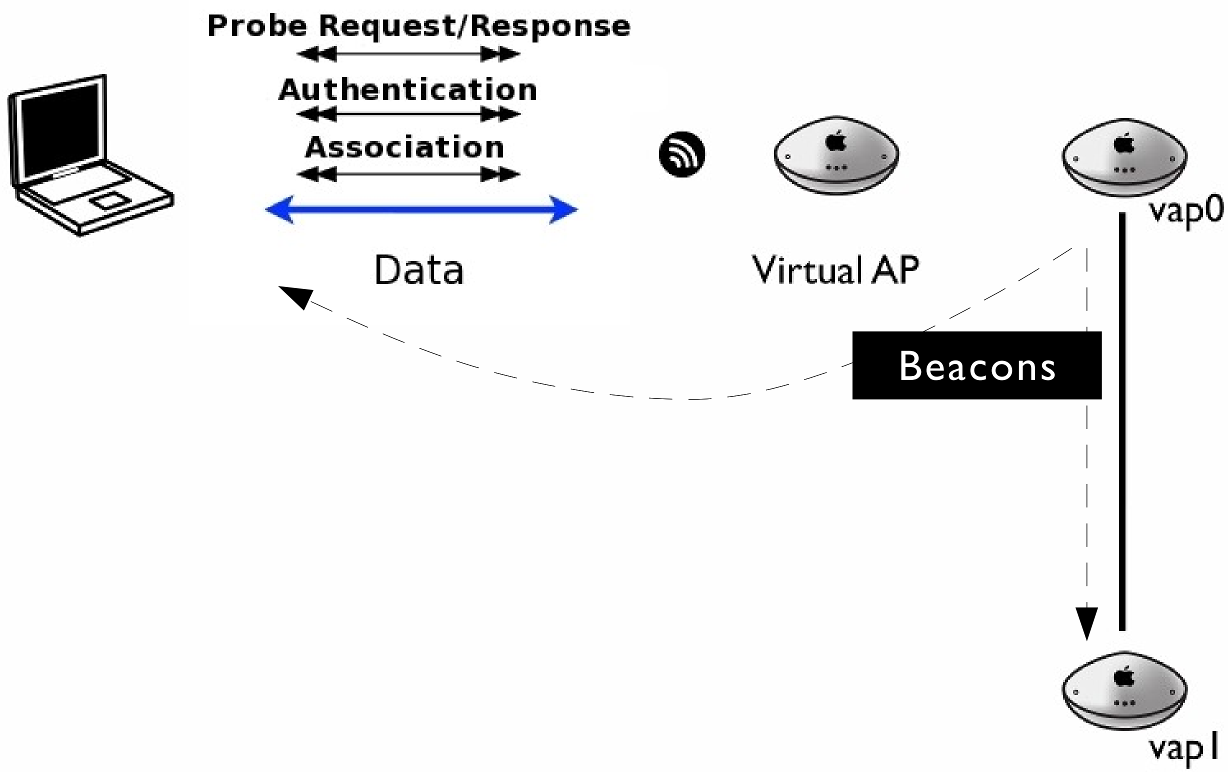
- Client can only send or receive packets at one time
- Proposed optimizations:
  - Early detection / triggering
  - Minimize scanning, even suppress it
  - Cached Authentication
- Always modifying the client behavior

# Virtual Access Points (VAP)

- Idea: Access Points in charge of mobility
- Solution: Move the AP with the client
- Ensured connectivity by the continuous reception of beacons
- One VAP per client:
  - Client always connected
  - Avoids handoff

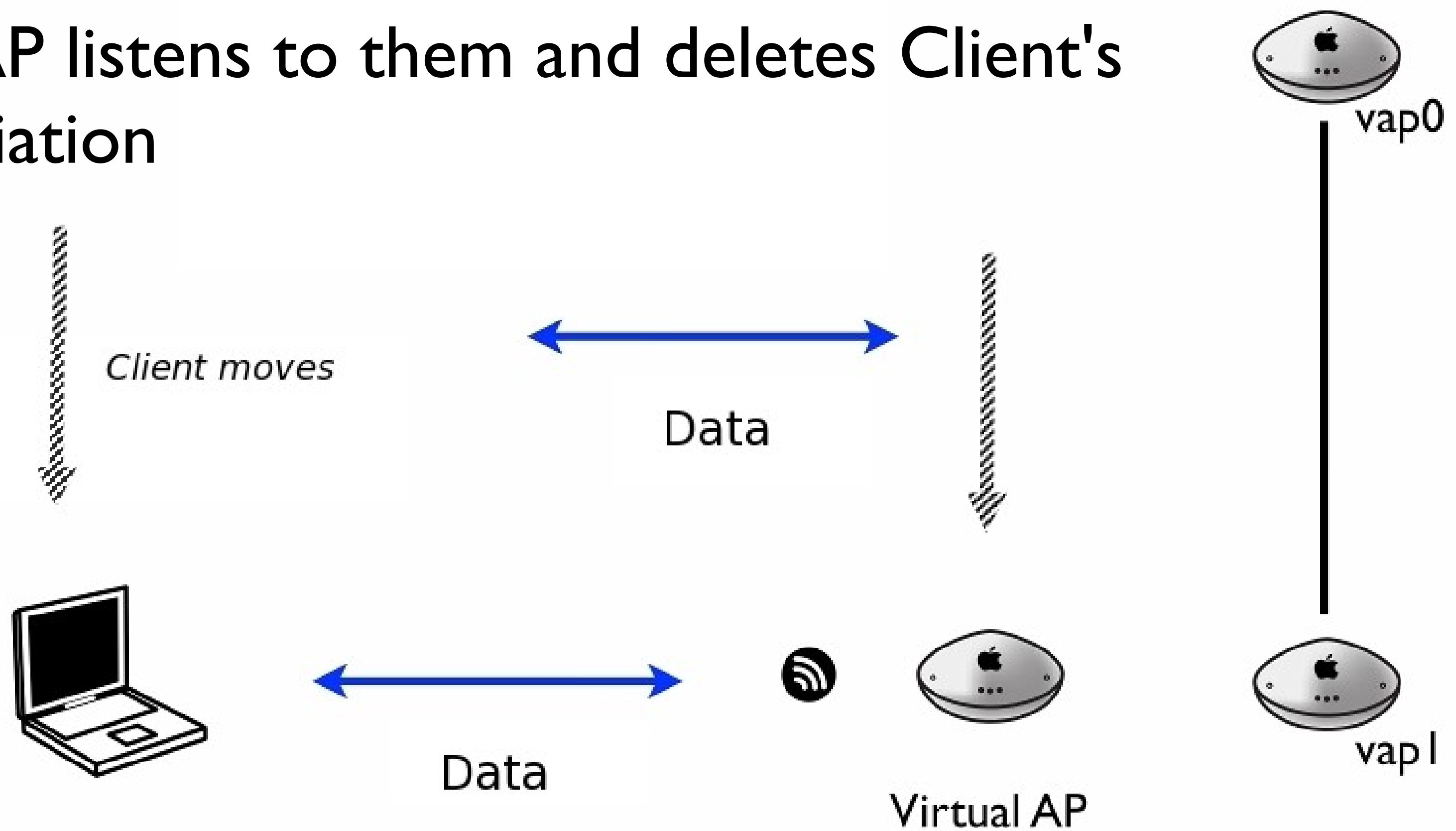
# VAP Example

- Each client has its own SSID. Example: "Client-00:11:22:33:44:55"
- AP sends Client's RSSI in the beacons



# VAP Example

- Client moves and new AP detects a better signal.
- Client is added to the new AP, who starts sending the beacons.
- Old AP listens to them and deletes Client's association



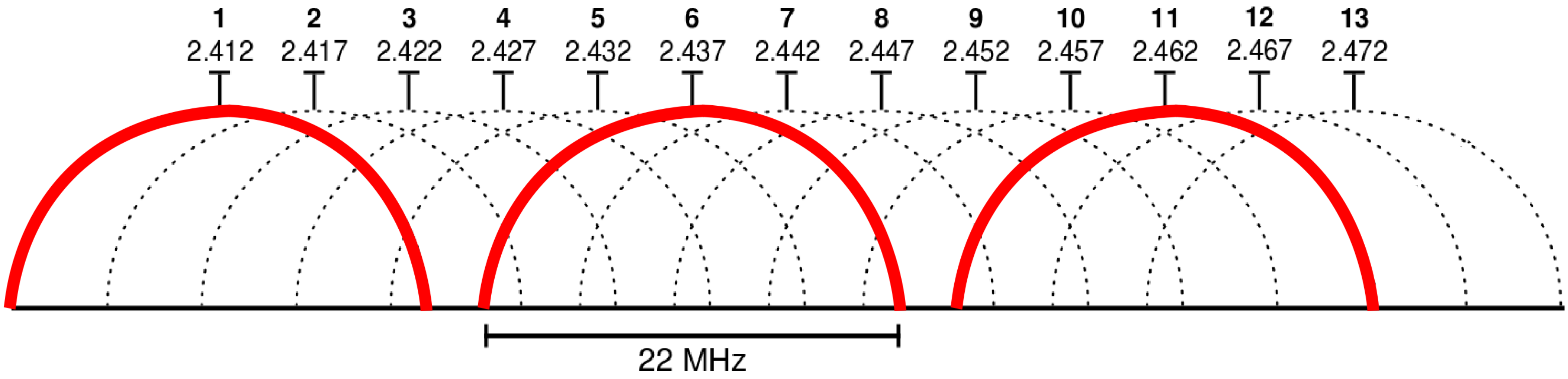
# Limitations

- Mono-channel (interference)
- Not scalable (collisions when many clients are active simultaneously)
  - AP sends one beacon per client
- No security context
  - No authentication with the new AP

# Our solution:
# Multichannel Virtual Access Points

# Multichannel Virtual Access Points

- WLANs use non-overlapped channels (1, 6, 11) to avoid interference
- Example 2.4 GHz (802.11b/g/n):

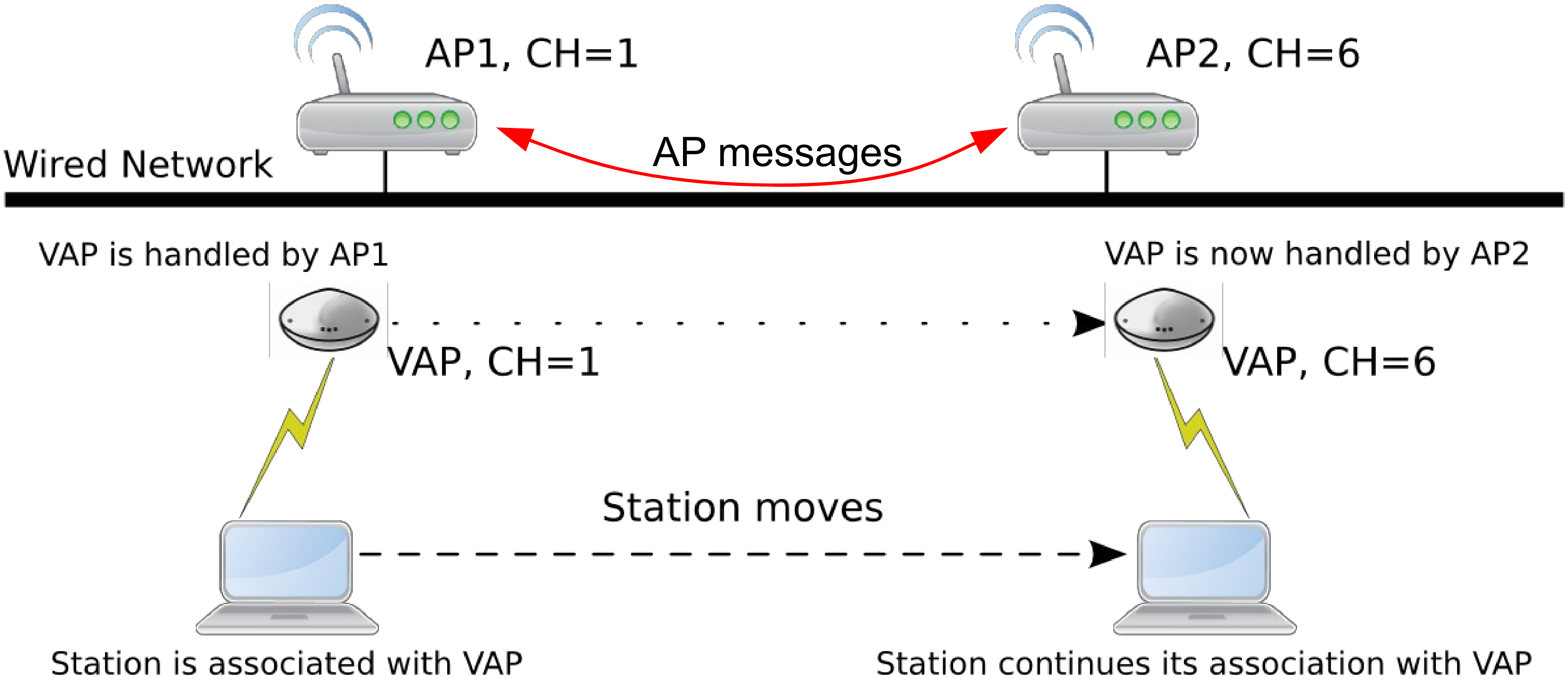


# Multichannel Virtual Access Points

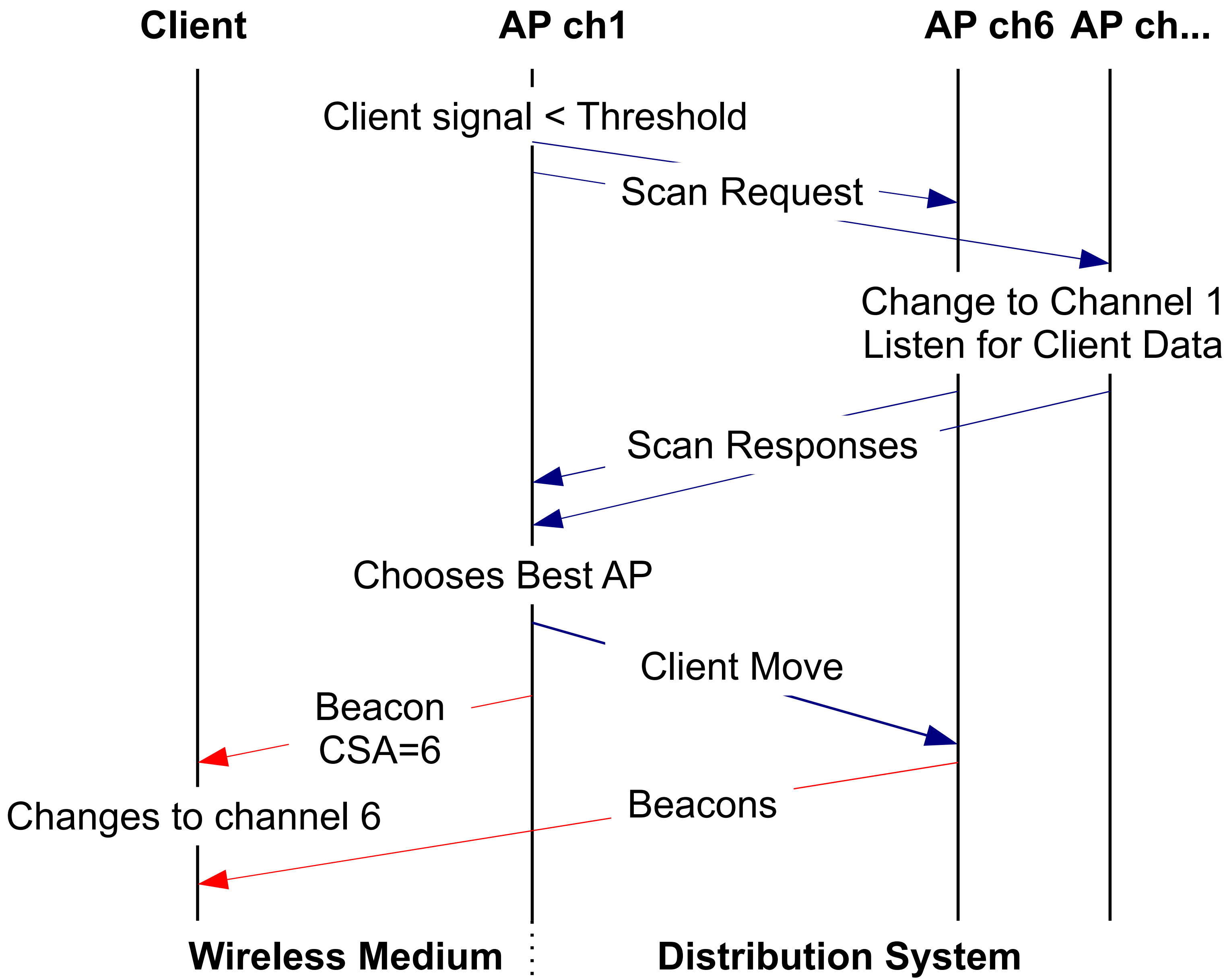
New Solution:

- APs listening on different channels
- Inter Access Point communication to determine new AP and moment of "client moving"
  - APs cannot hear beacons from other APs
- Changing channel by sending a Channel Switch Announcement in beacon (IEEE 802.11 standard)

# Multichannel Virtual Access Points

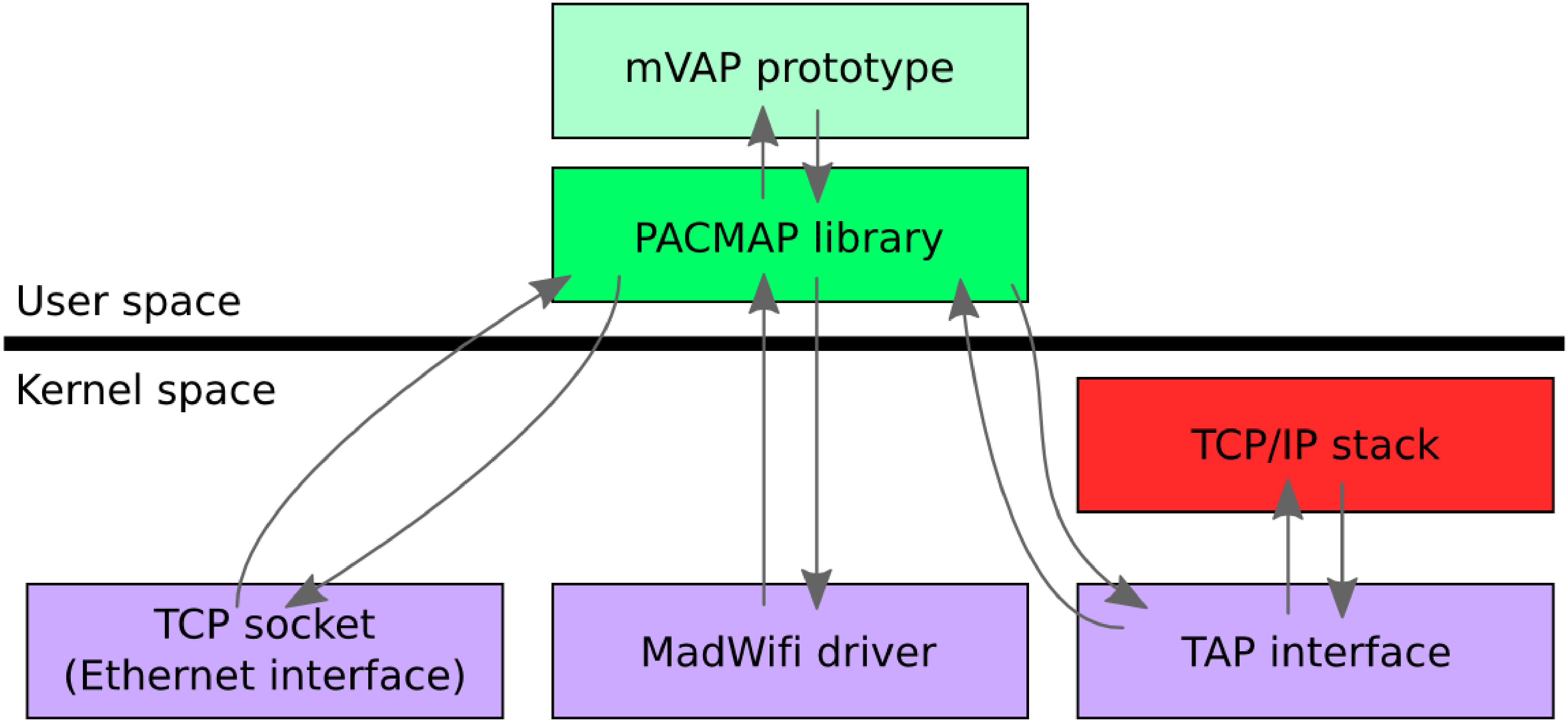


# Multichannel VAP in detail



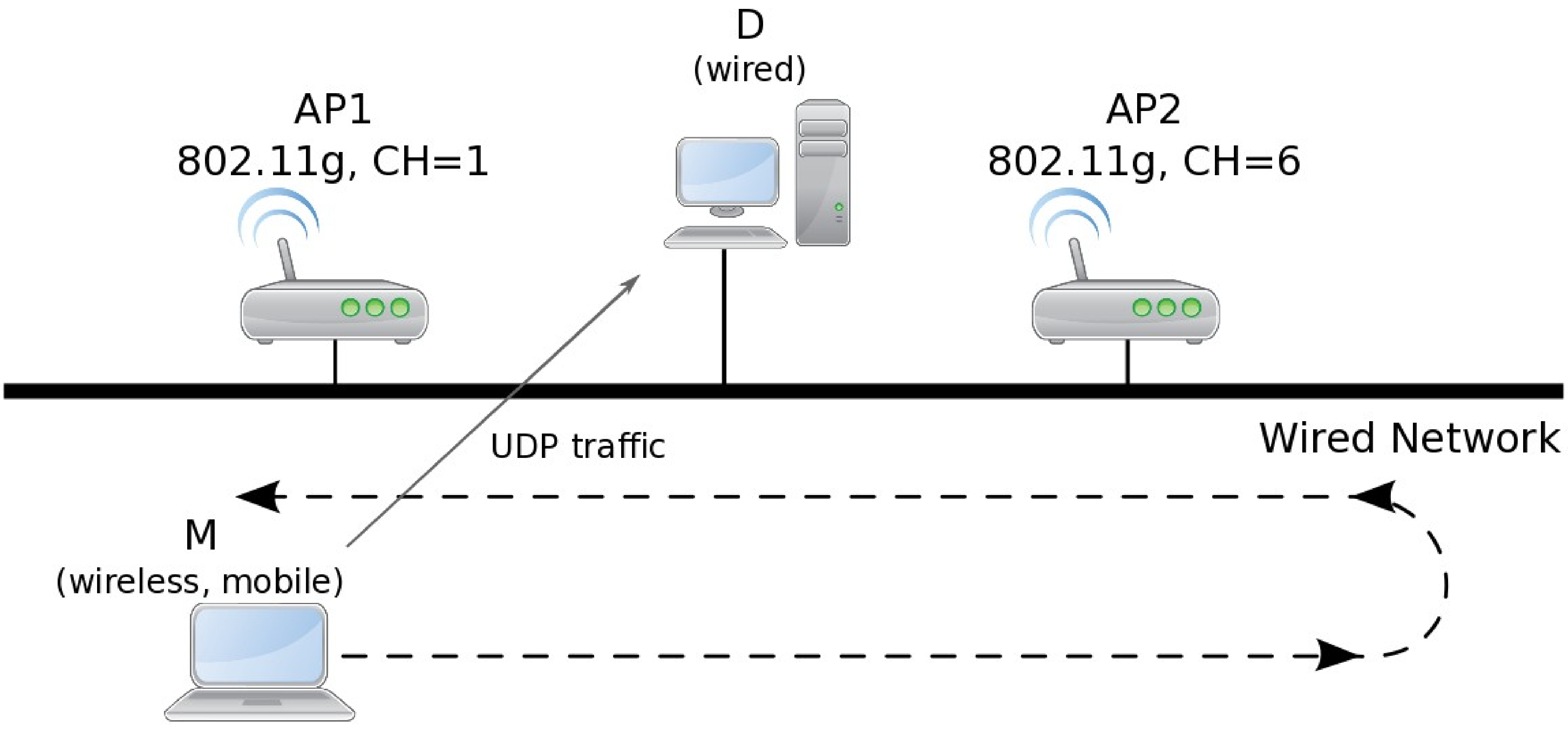
# PacMap: PACket MAniPulation framework

- Manipulates network packets from user space
- Wifi card = simple packet monitor/injector
- Linux implementation – C library

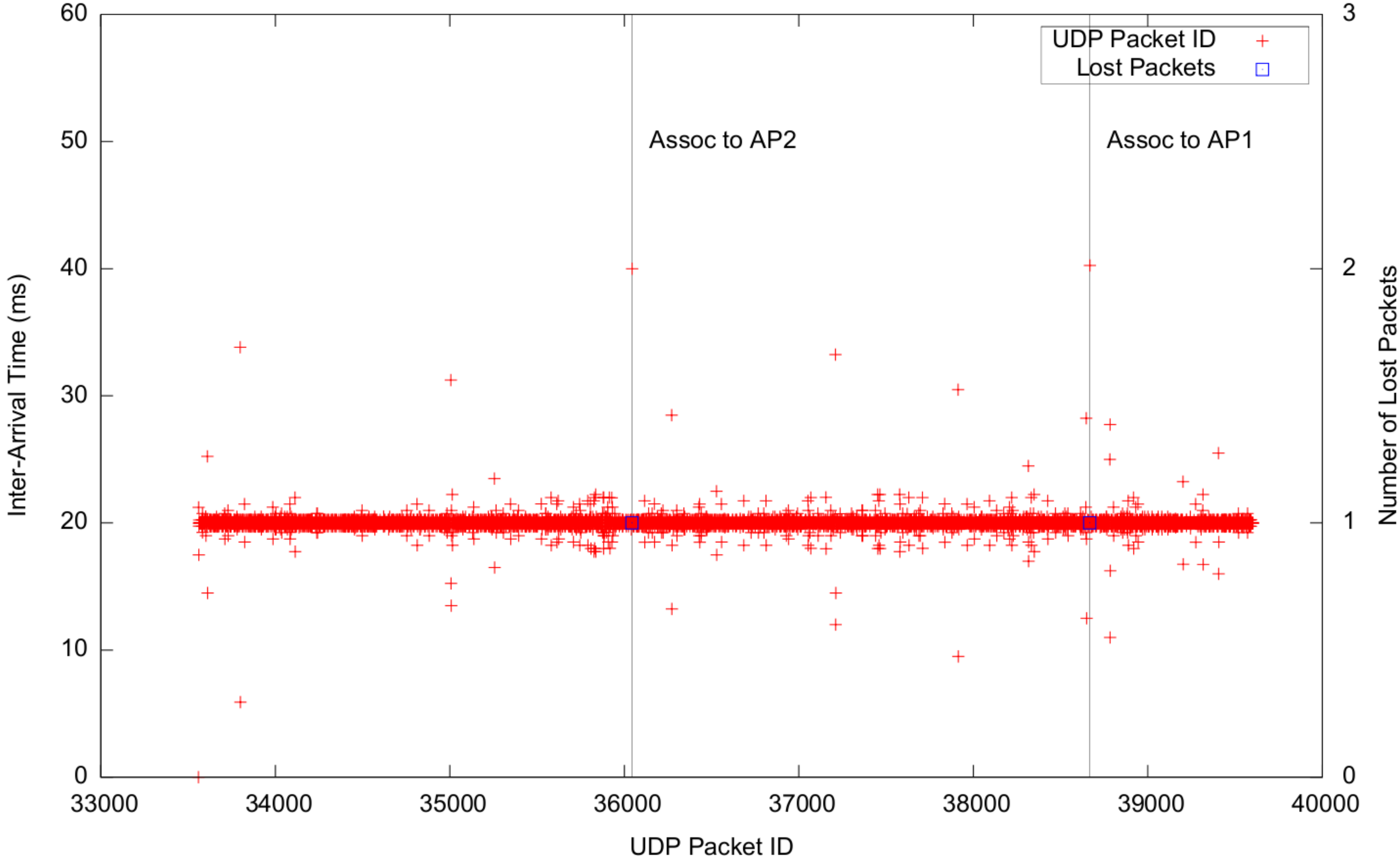


# Experimental Setup

- Client starts in AP1, changes to AP2, returns to AP1
- UDP traffic from M to D

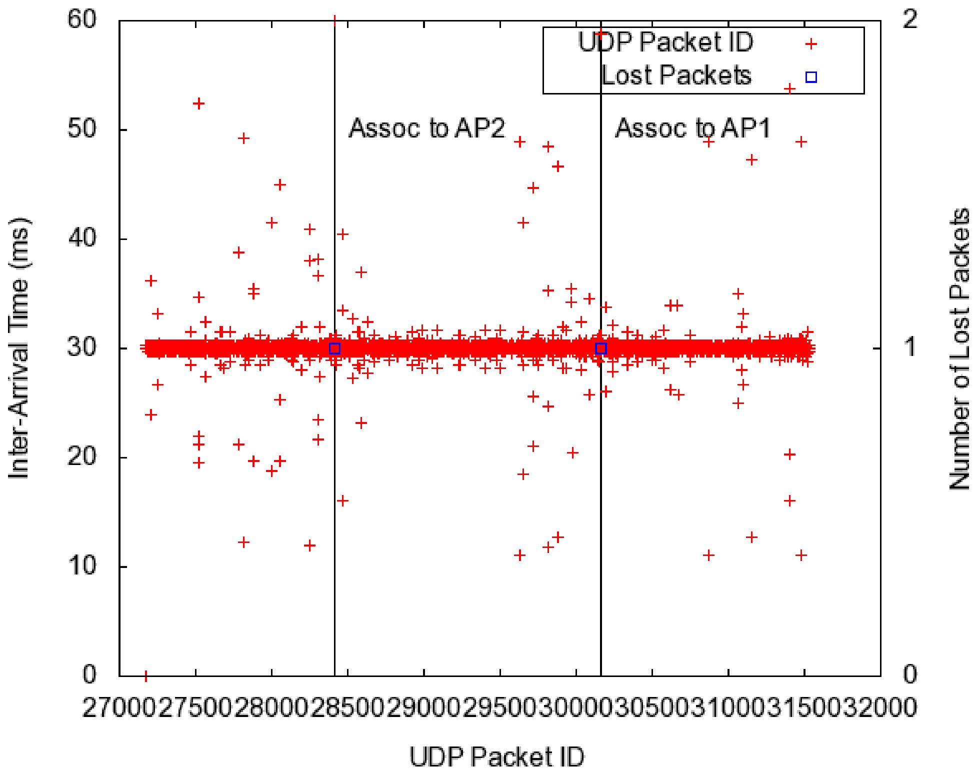


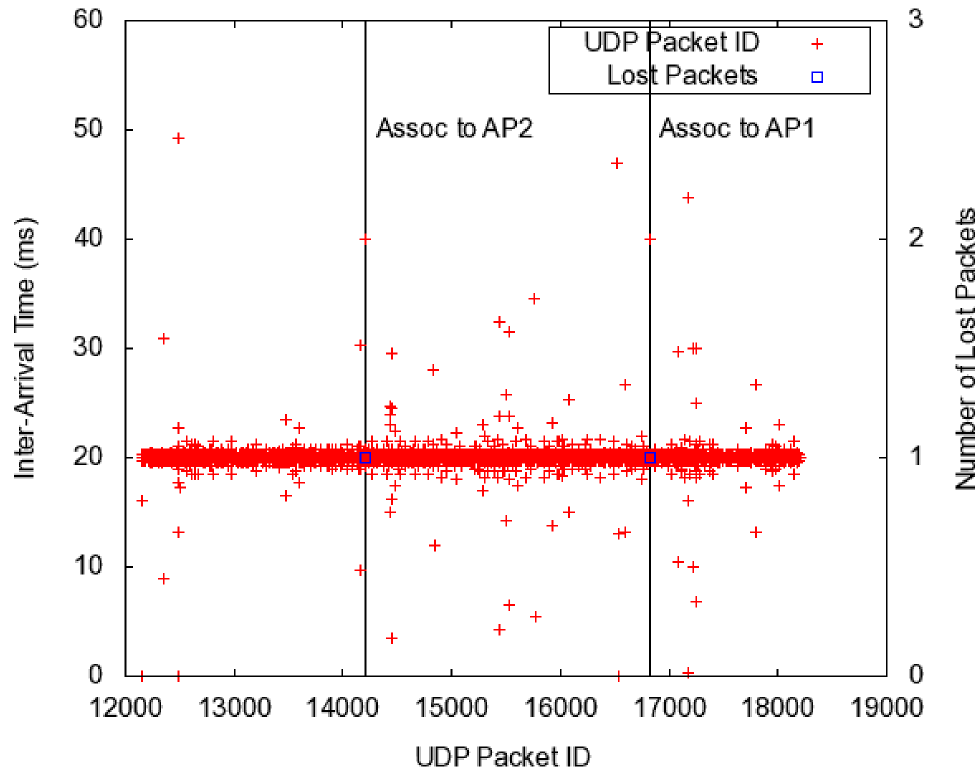
# Performance Results




G.729 Codec – 8kbps – 20 bytes / 20 ms

# Performance Results




G .728 Codec – 16kbps
60 bytes / 30 ms

G .711 Codec – 64kbps
160 bytes / 20 ms

# Conclusions and Future Work

# Conclusions

- WLANs allow client mobility
- Handoff process with high delay
- Real-time applications with constraints (VoIP)
- mVAP can be used for multichannel WLANs
- APs need to communicate between them through the DS: a protocol for AP messages is needed

# Future Work

- Use of 2 radios
- Security (IEEE 802.11i: WPA, 802.1X)
- Further study of an intra-AP protocol

# Thank you!

Questions?