Optimal Performance in Wireless Local Area Networks with Multiple Access Points

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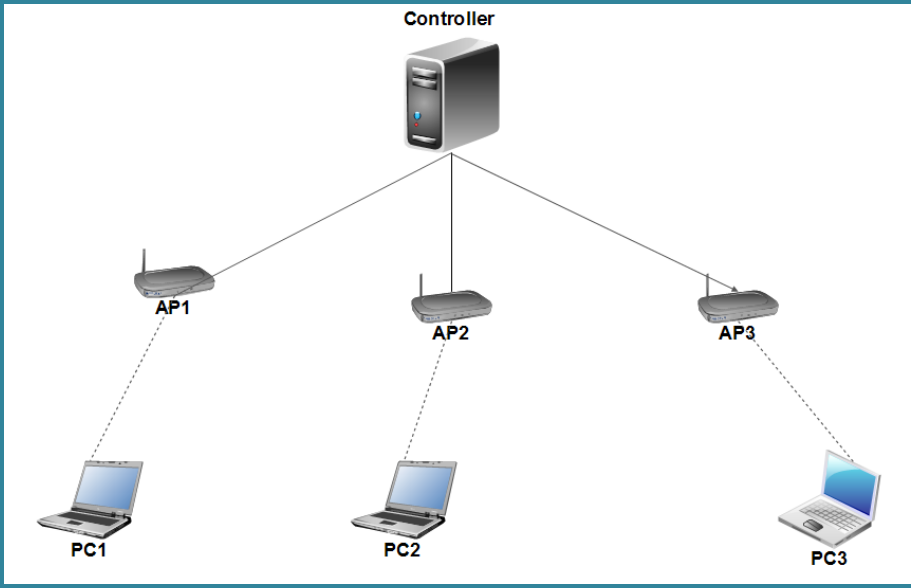
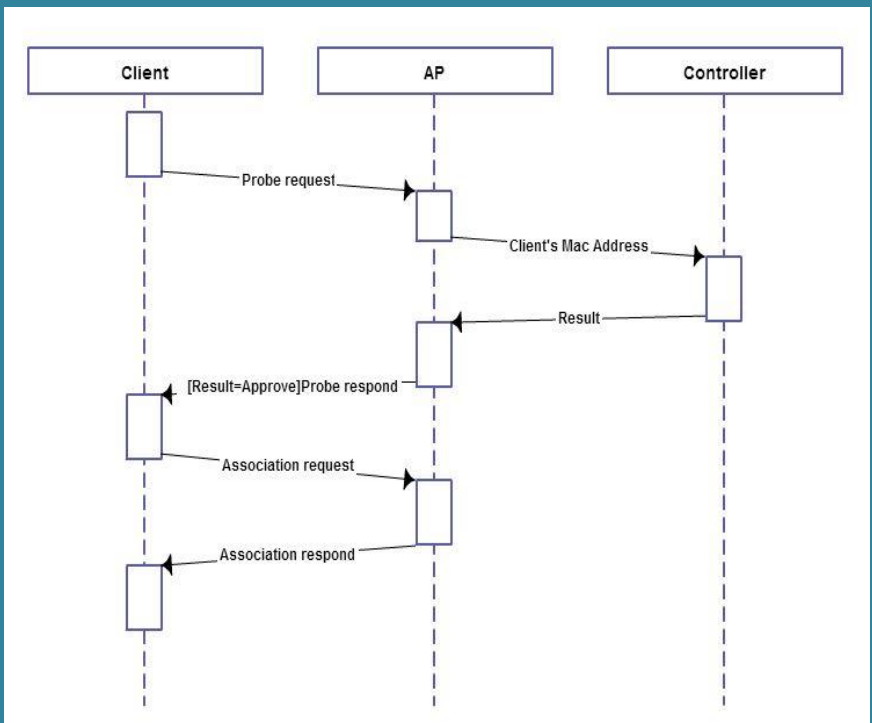
Introduction

This is a new approach to optimize the network performance by adding a controller with a provided algorithm in the network in order to perform AP selection and AP traffic control. AP selection is to select the best AP to user if a user requests for wireless network. AP traffic control is to manage the downstream of APs.

Infrastructure



Design

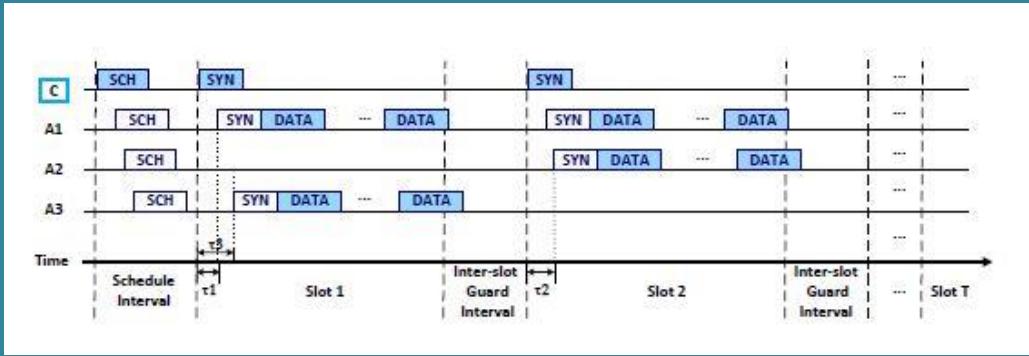


AP selection

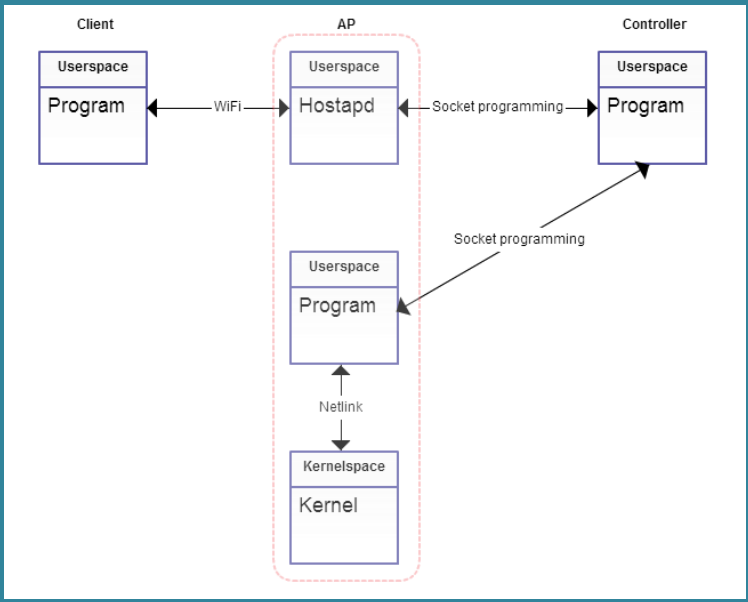
Client broadcasts probe request. After the AP receives the probe request, it sends signal strength, client AP mac address and AP Mac address to the controller. Controller calculates which AP is the best for a given client. It then sends the approved result to the designated AP. AP sends probe respond to the client. Then association can be done. If only one AP sends a probe request to client, client can only to connect to that designated AP. Therefore, AP selection to client can be accomplished by our system.

AP traffic control

First, the controller sends SCH (schedule) to all APs at the beginning, and then it sends SYN (synchronization) massage to all APs at each time slot. APs receive SYN and send data if they are allowed send data in that time slot based on the schedule.



Implementation



Client and AP are simply connected by Wifi, socket programming between AP and controller is the network communication tool, Netlink is a standard method to work between userspace and kernel.

Implement AP selection

Modify AP

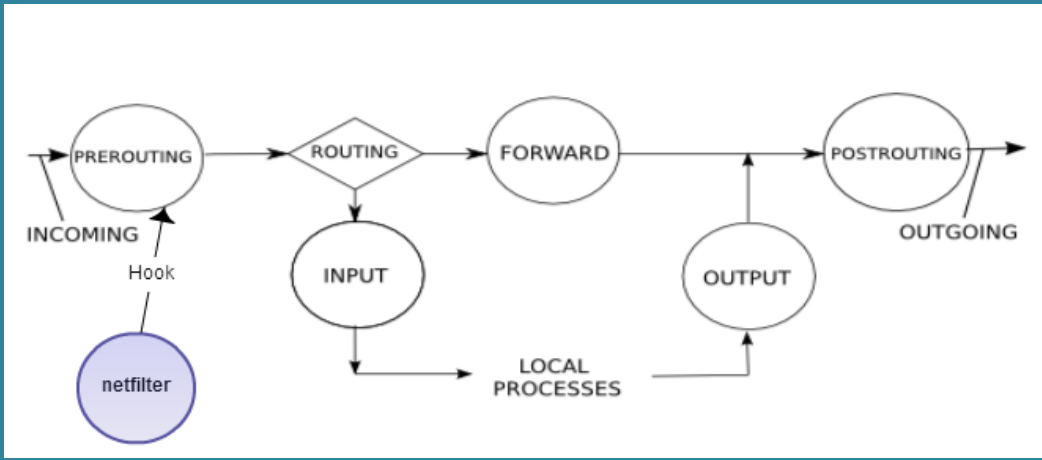
AP sends the information to the controller after receiving probe request. Then, it checks the response from the controller. If the response is positive, AP sends back probe response. Conversely, if the response is negative, AP stays idle.

```
1  if (receive probe request) {
2      send client mac address and AP mac address to controller;
3      wait controller's respond;
4      if (controller' respond is positive)
5          send probe response;
6      else
7          stop the function immediately;
8  }
```

Controller

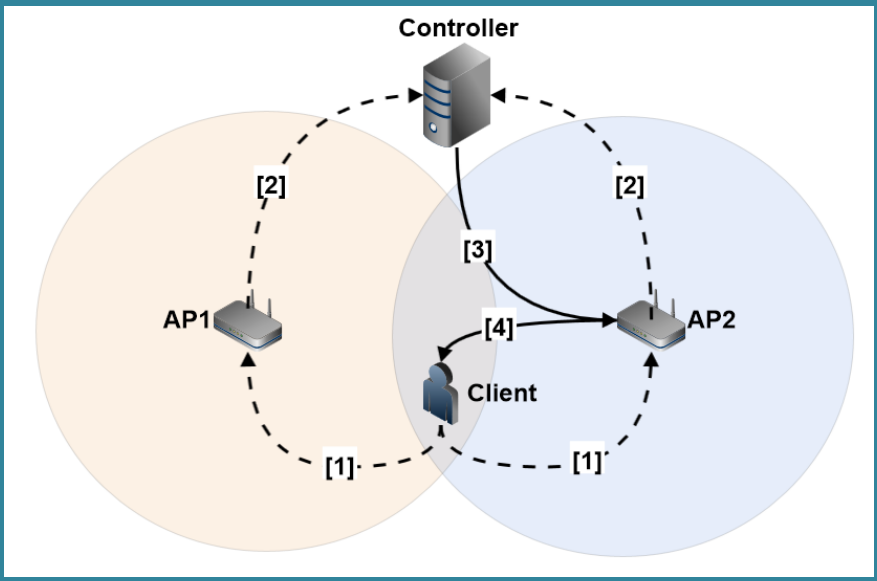
A controller is able to send the input text file with clients and APs information to algorithm and read the output text file produced by the algorithm. A program is implemented in controller to convert the result to schedule frame pattern.

Implement AP traffic control



In the AP kernel, A Netfilter is added to hook the pre-routing stage and control the traffic according schedule.

Result



[1] A Client in the cover area of 2 APs broadcasts probe request

[2] AP1 and AP2 receive request and inform controller

[3] Controller selects AP2 (Assume AP1 is busy) to give response

[4] AP2 sends probe response to client and AP1 ignore the client

Conclusion

Our system has been successfully implemented with 2 major functions which are AP selection and AP traffic control. With these 2 functions, we can provide the best AP to the client in order increase transmission speed. We can also control the packet sending time of APs to reduce the collision to zero. Although the system is a static system that can not apply to the dynamic network, it is a prototype of how we can improve the network performance. Future research can be built on our prototype to optimize the real network.