RTT matters

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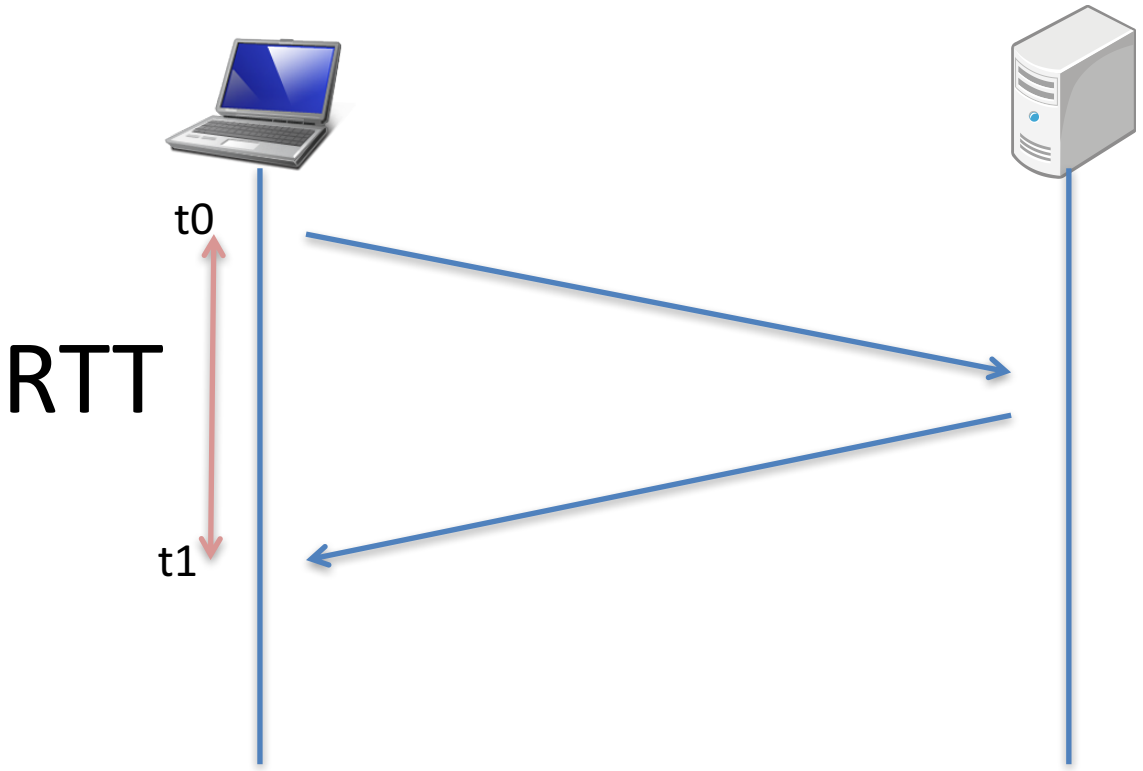
Round Trip Time (RTT)

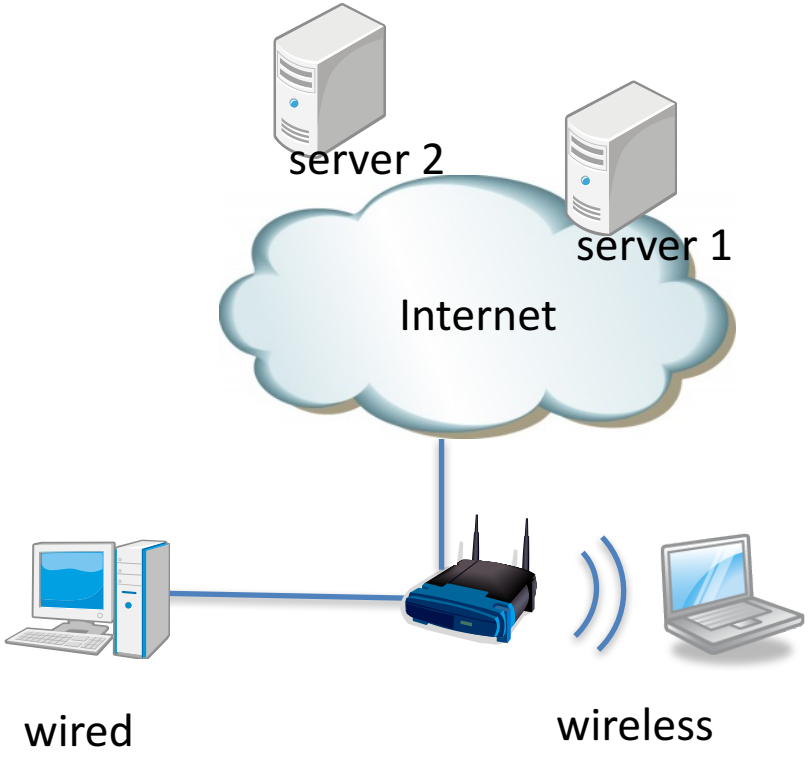


RTT

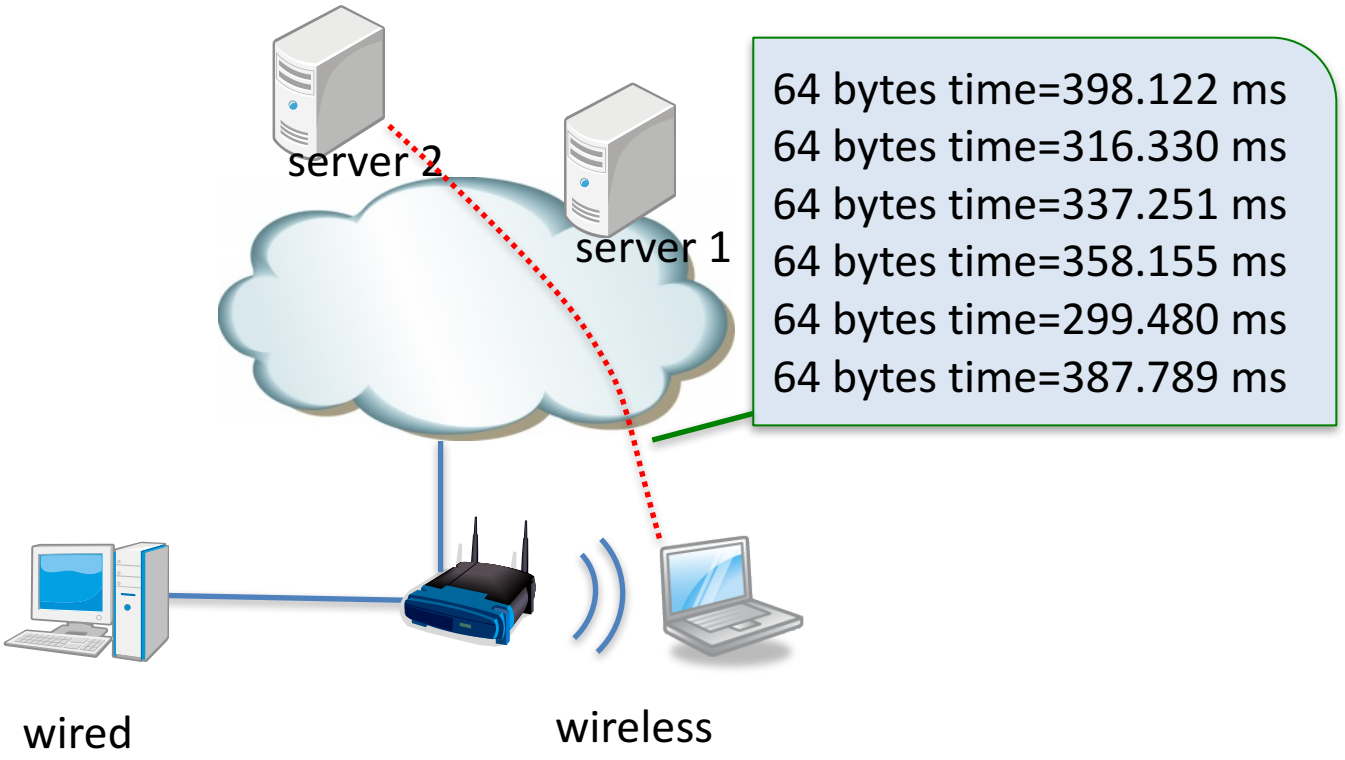
- The lower, the better
  - Faster TCP handshake
  - Better TCP throughput
  - Faster TCP recovery from a packet loss

- There are various efforts to improve TCP performance even in a high latency situation

WiFi is getting popular

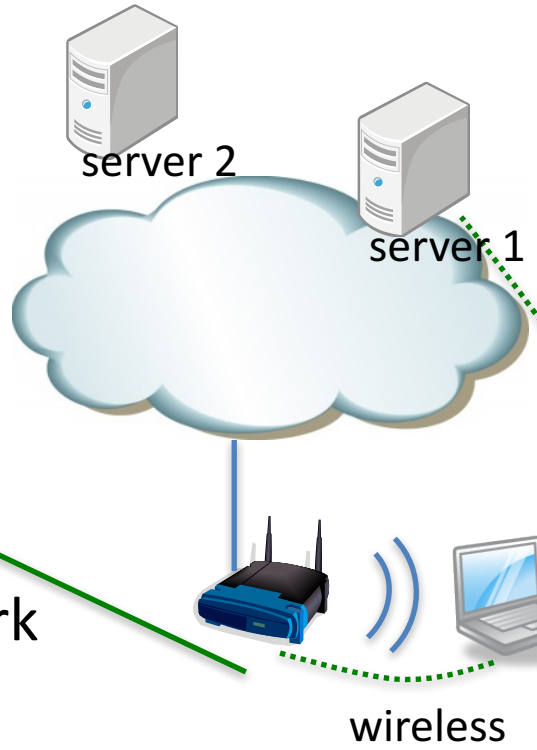


I faced a trouble



- RTT was not stable from a wireless client to the server 2. ☹

let’s try to isolate the problem




```
64 bytes time=3.757 ms
64 bytes time=3.789 ms
64 bytes time=3.768 ms
64 bytes time=3.718 ms
64 bytes time=3.644 ms
64 bytes time=3.762 ms
```

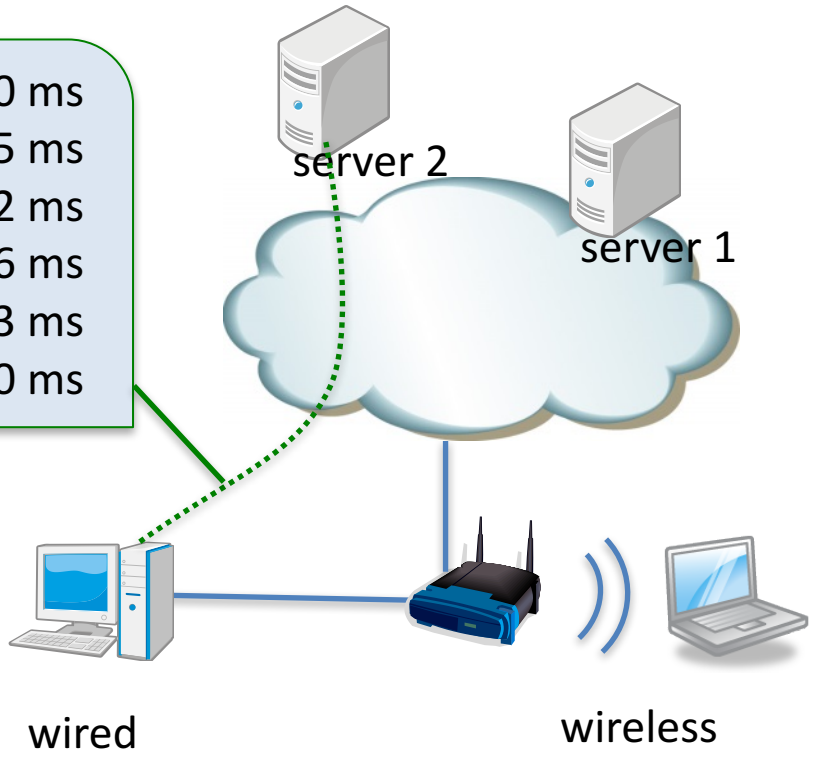
1) The local WiFi network looks pretty stable

```
64 bytes time=169.588 ms
64 bytes time=170.666 ms
64 bytes time=169.793 ms
64 bytes time=168.185 ms
64 bytes time=169.783 ms
64 bytes time=169.957 ms
```

2) RTT to server 1 looks also stable

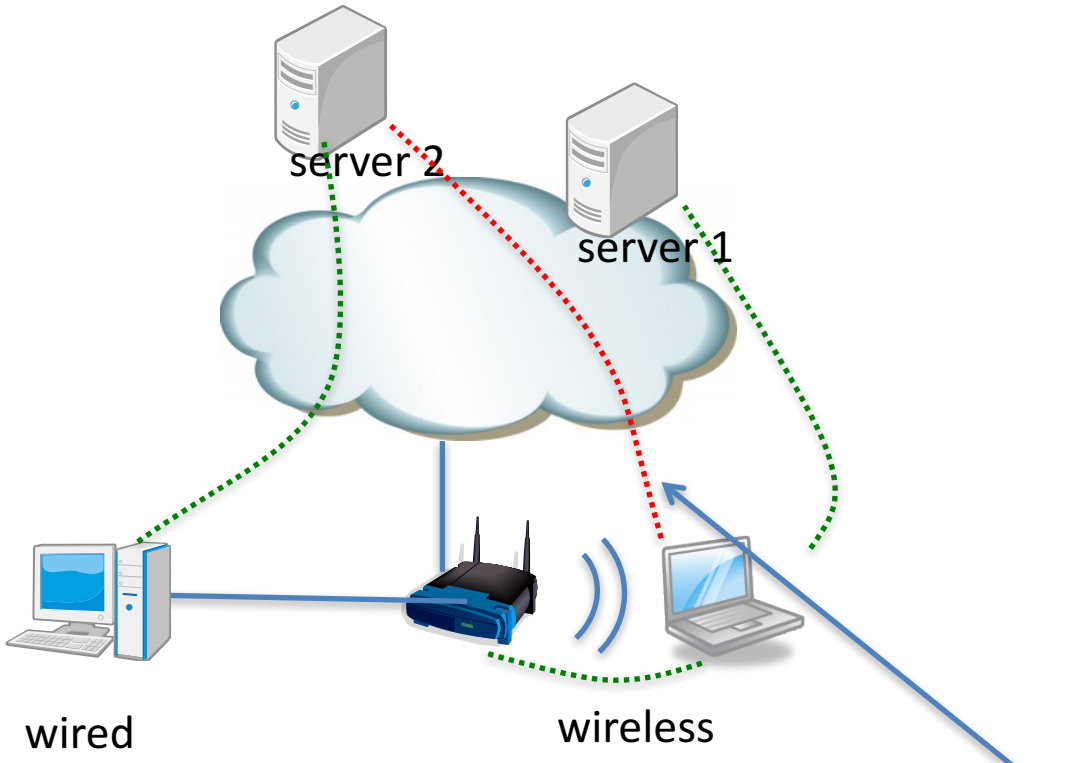
hmmm...

64 bytes time=296.040 ms
64 bytes time=296.105 ms
64 bytes time=296.442 ms
64 bytes time=296.186 ms
64 bytes time=296.103 ms
64 bytes time=296.070 ms



3) From the wired host in the same network, RTT to the server 2 looks stable

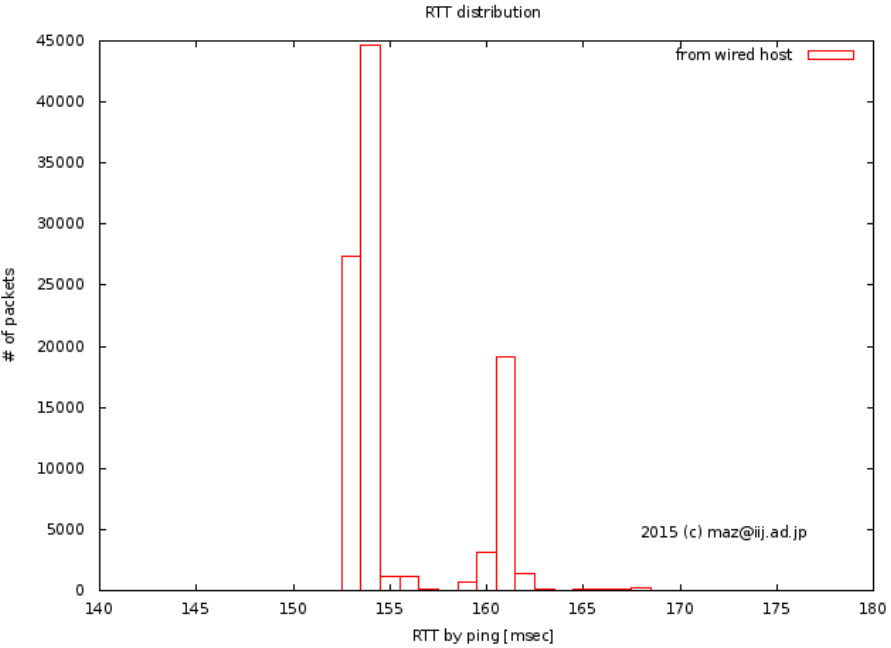
SO...



- This strange behavior happens only for this combination ☹

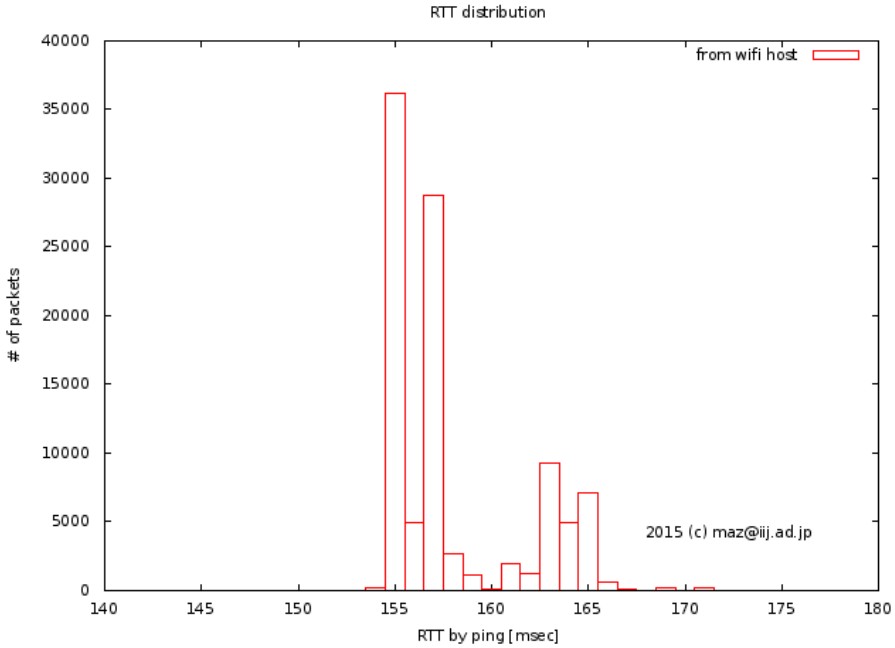
RTT distribution to server 1

wired



from wired host to server 1

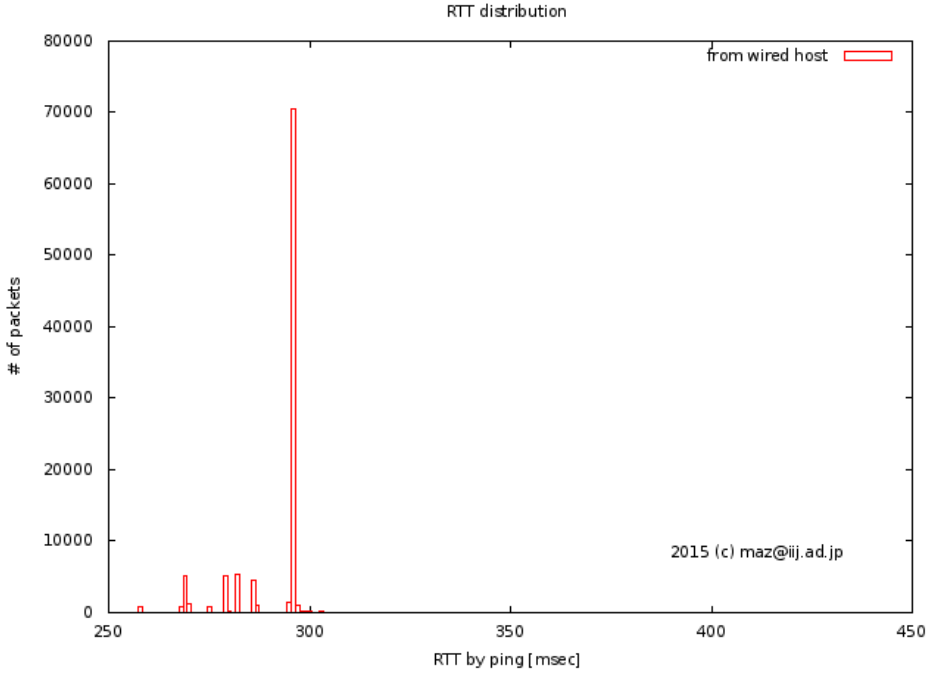
wifi



from wifi host to server 1

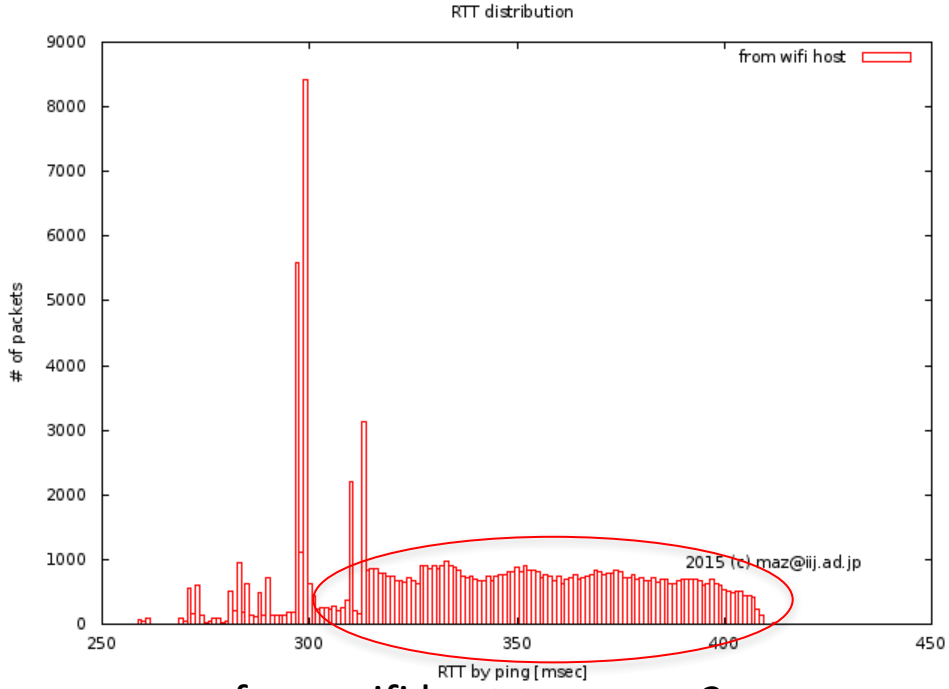
RTT distribution to server 2

wired



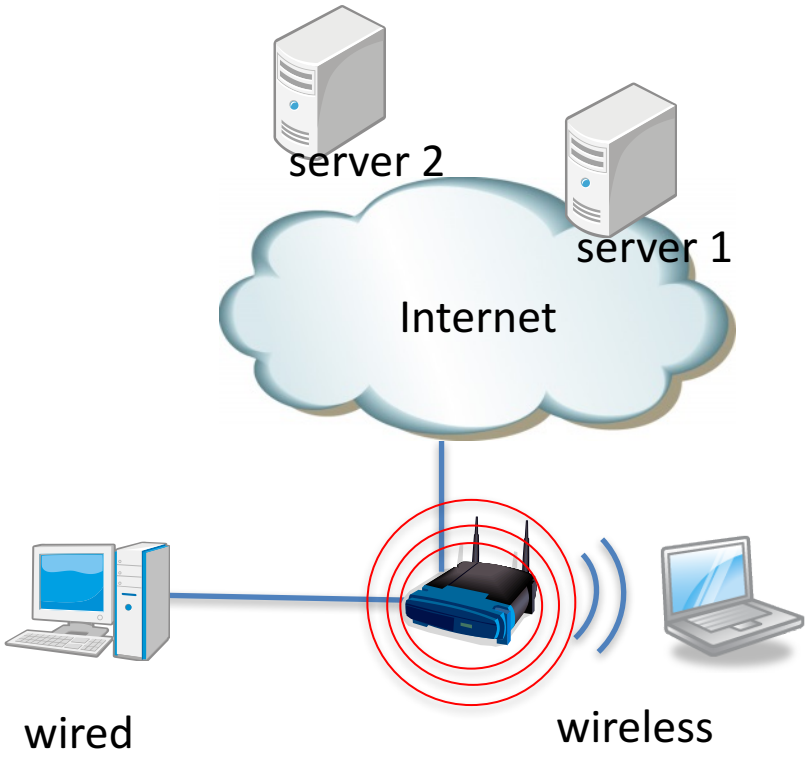
from wired host to server 2

wifi



from wifi host to server 2

WiFi AP was buffering packets



- This caused the unstable RTT ☹

My WiFi adapter does sleep

- To reduce battery usage
- Before sleeping, the client send a notification to the wifi AP, and the AP keeps packets until the client wake up

- My PC was asking the buffering!

WiFi AP sends beacon

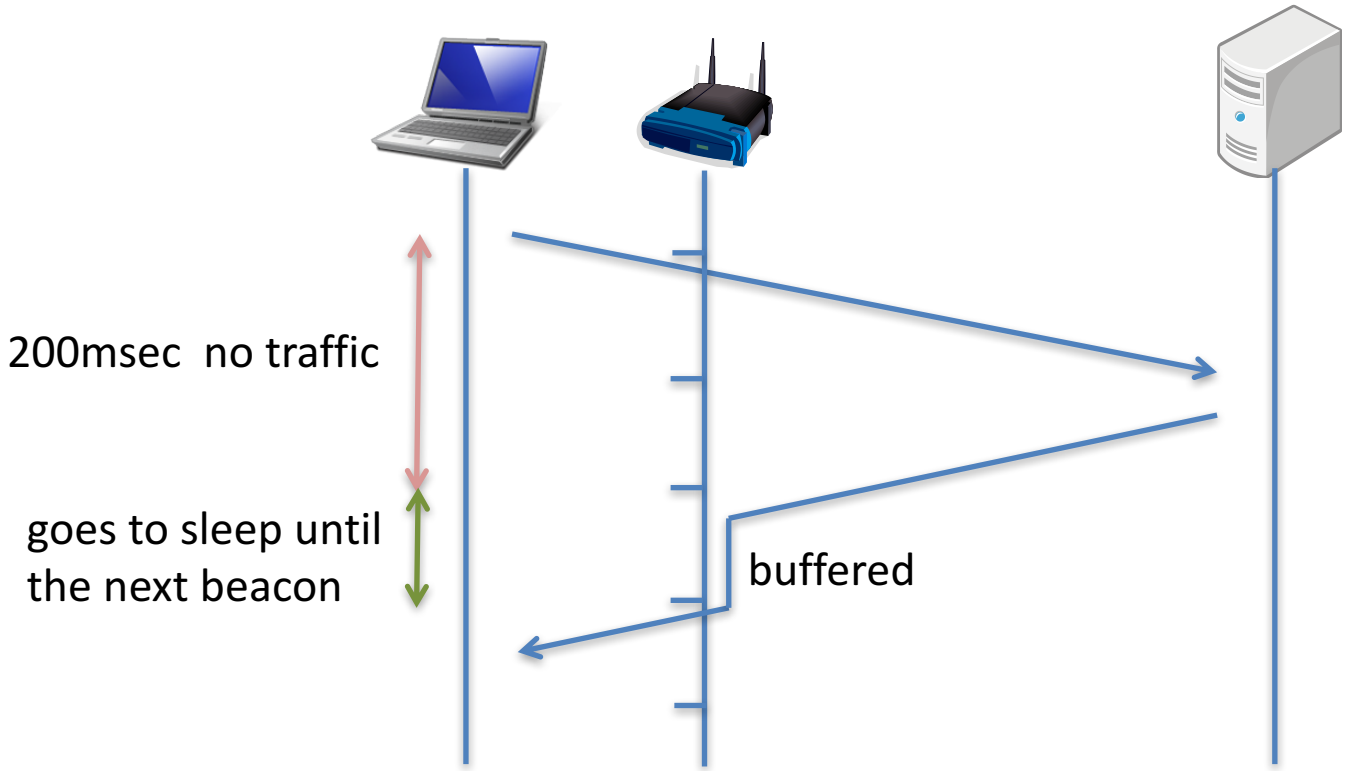
- Beacon interval
  - time interval between beacon transmissions
  - usually 100msec, but it's configurable
- TIM (Traffic Indication Map)
  - to tell any sleeping clients if the AP has any buffered frames present for it

- WiFi adapter can sleep between beacons, and wake up to check a beacon (TIM can indicate if the adapter need to receive data or not)

The scenario

- My wifi adapter went to sleep after 200msec of no traffic
  - that's why the unstable RTT happens only when I was communicating with server 2 (average RTT is 300msec)
- Based on the beacon interval information (which was 100msec in my case), it woke up and received a response
  - that's why most RTT distribution is within 100msec

Sleeping and buffering



Summary

- Strange RTT behavior happens if your communication is between:
  - a host connected to a wifi network and
  - a far end host (RTT>200msec)
- A WiFi adapter goes to sleep
  - “200msec of no traffic” seems a common trigger
- The sleep duration is manageable by setting beacon interval on your WiFi AP
  - 100msec would be reasonable
  - You might be able to reduce battery usage by setting it as 1000msec, but this could introduce more RTT penalty
  - You can enable U-APSD if your AP supports it so that clients can actually schedule the duration by itself.