

# Vehicular experiments dataset

## Objective:

Capture multiple parameters of 802.11 links between a stationary AP and a vehicle moving at realistic speeds. We use 3 different types of 802.11 standards: n, ac (wave 1) and ad.

## Experiment description:

- Vehicle movement on a grid with distances [here](#). Notice building at SW corner of intersection : blocks line-of-sight to AP when vehicle is on the lower N-S portion of the circuit
- Data divided in traces, performed on different dates, using different vehicles to support the AP on the roof, as shown below:

trace nr	date	start time	n(n)	n(ac)	n(ad)	vehicle AP	n(clients)
302	2019-08-20	10:28:45	3262	2787	423	honda civic sedan 2001	1
303	2019-08-20	11:26:23	3374	3027	312	-	2
304	2019-08-20	12:39:46	1711	216	14	-	3 (n & ac) 2 (ad)
401	2019-08-22	10:19:24	1685	1681	545	peugeot partner 2002	1
402	2019-08-22	10:48:26	2859	2827	764	-	2
403	2019-08-22	11:39:36	135	135	116	-	2
404	2019-08-22	11:42:50	114	114	53	-	2
405	2019-08-22	11:45:07	2019	2019	507	-	2

- **APs:** all positioned at coordinates {lat : 41.111879, lon : -8.631146}

ap	device	802.11 type	channel	cntr. freq (MHz)	bw (MHz)
unifi-003	ubiquiti ac lite	n	6	2437	20
unifi-001	-	ac	40	5200	40
tp-01	tp-link talon ad7200*	ad	1	60480	2160

\*running tp-link's original firmware, not OpenWrt

- **Main clients:** all positioned in the moving vehicle's roof, a vw golf mk3

802.11 type	radio	nr. antennas	laptop
n	csl usb 2.0 wlan Adapter 300 Mbps	2	m1
ac	tp-link archer t4uh	2	w4
ad	tp-link talon ad7200 (tp-03)	-	w4

- **Background clients:** the purpose is to increase channel util.

802.11 type	radio	nr. antennas	laptop	position
n	tp-link wn722n	1	w2	fixed, ~2m away from AP
n	tp-link wn722n	1	w3	"
ac	csl usb 2.0 wlan Adapter 300 Mbps	2	w2	"
ac	csl usb 2.0 wlan Adapter 300 Mbps	2	w3	"
ad	tp-link talon ad7200 (tp-04)	-	macbook	stopped vehicle's roof

- **Monitor nodes:** all positioned in the moving vehicle's roof

802.11 type	radio	nr. antennas	laptop
n	csl usb 2.0 wlan Adapter 300 Mbps	2	m1
ac	tp-link talon ad7200 (tp-02)	8	w4
ad	tp-link talon ad7200 (tp-02)	-	w4

## Dataset structure:

All the packet captures are already digested and ready to use in the file

`wifi-exp-log-summary.csv` . An explanation of the fields below:

- **sys time** : system time (1 Hz resolution) that this row refers to. All node clocks were synchronized through NTP.

- **traceNr** : nr. of the trace the row belongs to.
- **lon** : longitude (in degrees) reported by the receiver's GPS at `sysTime`
- **lat** : latitude reported by the receiver's GPS at `sysTime`
- **receiverAlt** : altitude (in meters) reported by the receiver's GPS at `sysTime`
- **receiverX** : x coordinate of the receiver's position when space is discretized as a Cartesian plane and the sender is set to be the origin of the coordinate system. The x axis corresponds to east-west (positive values are east, negative values are west). Unit is meters.
- **receiverY** : y coordinate of the receiver's position when space is discretized as a Cartesian plane
- **receiverDist** : distance (in meters) of receiver to ap(s)
- **receiverSpeed** : speed (in m/s) reported by the receiver's GPS at `sysTime`
- **receiverId** : system-specific id for the client (in the vehicle)
- **senderId** : system-specific id for the ap serving the client (side of the road)
- **isLperOn** : 1 if row's `sysTime` corresponds to a period where our UDP packet consumer application is known to have been running on the receiver side.
- **isInLap** : 1 if this row's `sysTime` has been marked as being part of a time period where clients were doing laps around the APs, 0 otherwise.
- **rssMean** : the mean of the RSSI (Received Signal Strength Indicator) values of frames received by the client from the ap during the 1-second period `sysTime` period the row refers to.
- **snrMean** : SNR (signal to noise ratio) retrieved from 802.11ad sector sweep frames.
- **channelFreq** : center frequency of the WiFi channel used, in MHz.
- **channelBw** : bandwidth of the WiFi channel used, in MHz.
- **channelUtil** : percentage of time the wireless medium was sensed to be busy during the 1-second period `sysTime` period the row refers to. **In traces 40x, the 802.11n and ac routers didn't log channel busy time, and as such we had to approximate channel util. based on x,y coordinates and nr. of active clients.**
- **wifiType** : 802.11 type (e.g., n, ac or ad).
- **nrClients** : nr. of parallel clients operating in `wifiType` mode, on the same channel and bandwidth as `receiverId`.
- **dataRateMedian** : the median of the bitrate values of frames received by the client from the ap during the 1-second period `sysTime` period the row refers to.
- **dataRateMean** : the mean of the bitrate values of frames received by the client from the ap during the 1-second period `sysTime` period the row refers to.
- **nBytesReceived** : total number of bytes received by the client from the ap during the 1-second period `sysTime` period the row refers to.
- **tghptConsumer** : throughput reported by the UDP packet consumer application, during the 1-second period `sysTime` period the row refers to.
- **nRetries** : nr. of WLAN-level re-transmissions on 1 second period
- **meanBeaconRssi** : mean RSSI measured from beacons in 1 second period. nan values are filled with -100 dBm.

- **meanInterBeaconTime** : mean interval between consecutive beacons, within 1 second period. nan values are filled with 1 sec.
- **nBeacons** : total nr. of beacons received by client within 1 second period.