SDN-ORIENTED GLOBAL NETWORK OPTIMIZATION ALGORITHM

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Motivation of the work

Currently, mobile terminals feature multiple interfaces to adapt to the steadily increasing number of available wireless access networks. This provides a suitable ground for offloading data from cellular to different WIFI access points using the integration of WIFI and LTE offered by LTE v.12 and v.13. There is a parallel trend towards network programming relying on centralized controllers, of which the Software-Defined Network (SDN)[1] architecture with the OpenFlow[2] protocol is a clear exponent. Moreover, since 5G networks are expected to support latency-critical applications, any decision delay should be minimized whenever possible. To this end, we propose to take near instantaneous decisions based exclusively on extremely simple network-side estimations of the history of user terminals.

Thesis Objectives

We intend to design and implement a SDN-oriented global network optimization algorithm.
This algorithm will use flow steering and will be applied on an SDN[1] architecture in which the end-terminals are integrated with the core network.[3].

Research plan

1. First year

Part 1

- Establishing an essential knowledge of cellular standards.
- Establishing an essential knowledge of network protocols:
  - Network managing protocols: ICMP, SNMP.
  - Network managing flow-based protocols: sFlow, OpenFlow, NetFlow.
  - Remote terminal configuration protocols: SNMP, NetConf, TR-069, OMA LWM2M.
  - Statistics collection daemons: collected, sFlow.
- Mastering SDN:
  - Applying the SDN approach to control a wireless network using the Mininet test bed.
  - Using the RYU controller to monitor, configure and manage flows in a network.

Part 2

- Design of a network prototype.
- Use the Mininet test bed to emulate a backhaul network based on the designed prototype.
- Control the network using the RYU controller.

2. Second year

Part 1

- Designing a Global Network Optimization Algorithm.

Part 2

- Mile stone: Submitting a paper to a conference (June 2016) [4].

3. Third year

part 1

- Adding user profiling to upgrade optimization algorithm performance.

Part 2

- Enhancement of the optimization algorithm by developing and adding a mobility plug-in.
- Mile stone: Submitting a journal paper (May 2018) [5]

Next Year Objectives

- Defend the thesis.

Current work

- Writing the thesis.

Results

We applied Kalman filtering, to predict terminal positions [6] [7].

We managed to predict the right position of the terminal with a success rate of ***75%***.

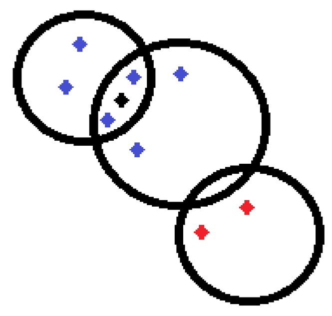
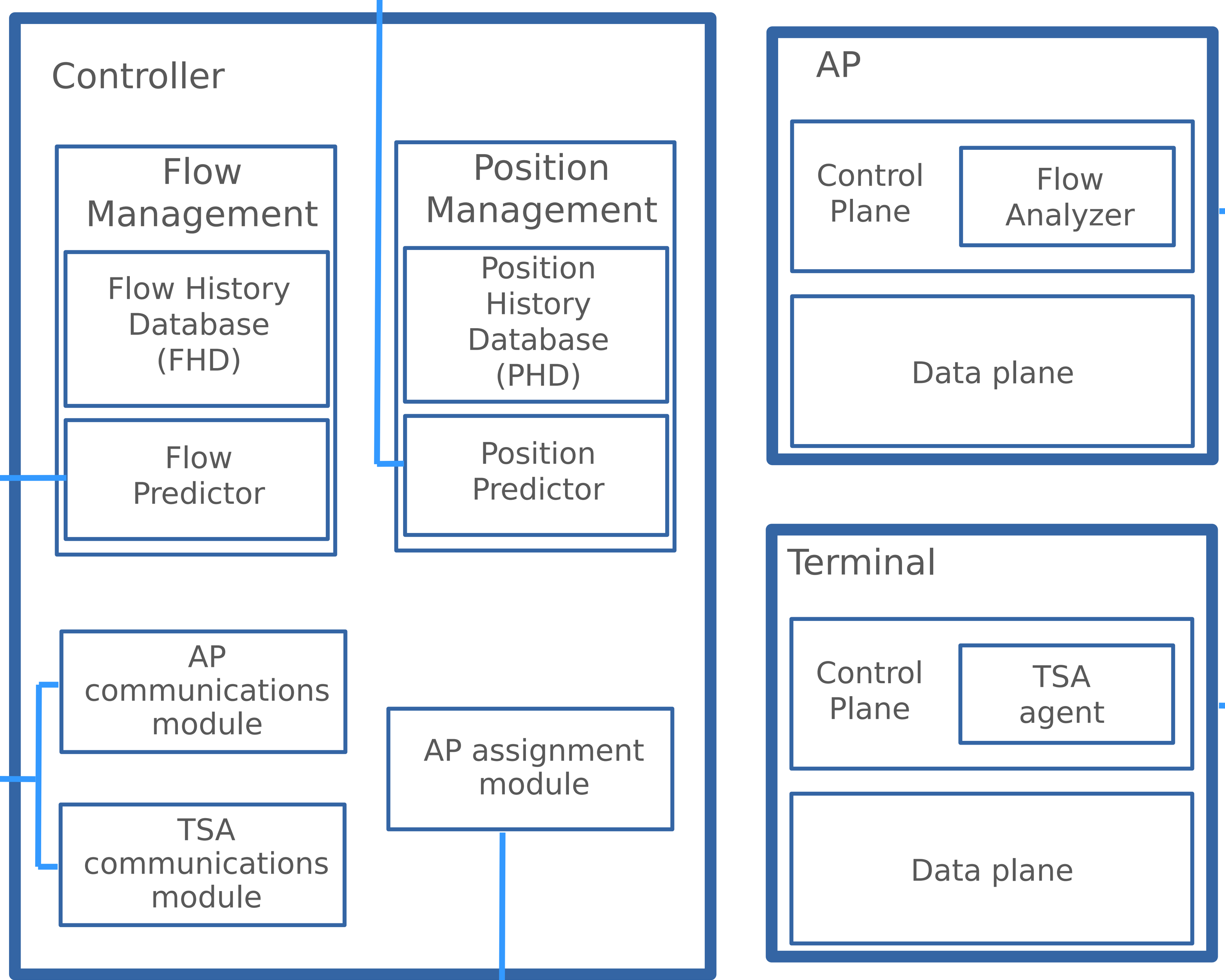
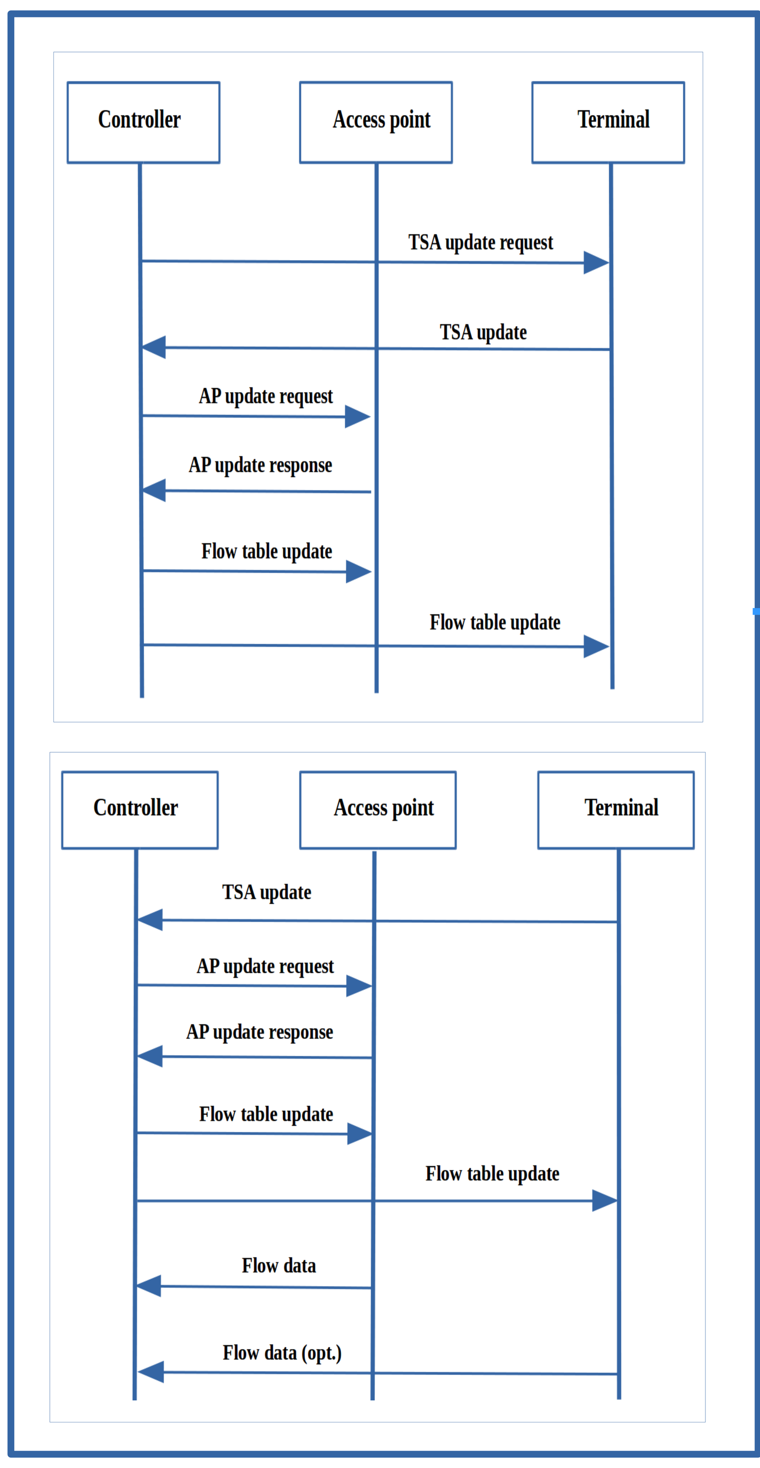


Fig 1 : Terminal position prediction

This module analyzes terminal flows in the background to characterize them. This information is sent to the controller to be stored in the FHD.

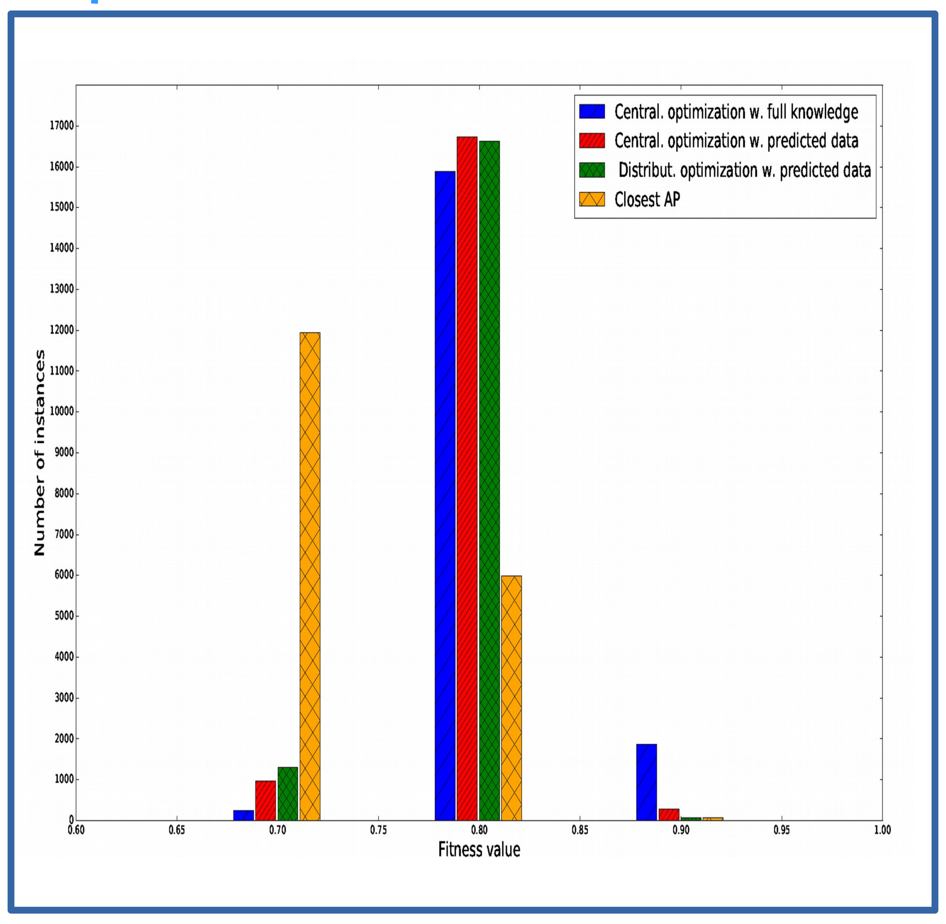
We developed a flow predictor that is able to predict the next flow type generated by the terminals with an average F value of ***0,85***. It was presented in the IPIN 2016 [2].





This agent sets connections with the APs as commanded by the controller. It may also send terminal information to the controller, if allowed by the user to do so. In that case, flow analysis (by the flow analyzer module) or position prediction (by the position management module) are unnecessary. It have been tested [8], published [1] and patterned[9].

	φ	P (φ)	D(φ)	P AV (φ)	SD(φ)
Centralized optimization with full knowledge[10] vs. Centralized optimization from predictions based on historic data	0	59.811	0.010	1.304	0.041
	5	19.300	0.078	9.789	0.034
	10	7.661	0.112	14.463	0.028
Optimization from predictions based on historic data, centralized vs. distributed versions	0	61.039	0.008	1.090	0.036
	5	18.441	0.058	7.197	0.013
	10	1.310	0.091	11.484	0.011
Distributed optimization from predictions based on historic data vs. closest-AP schema	0	86.050	0.046	5.931	0.042
	5	59.855	0.073	9.426	0.022
	10	23.477	0.096	12.460	0.014



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