SDN-ORIENTED GLOBAL NETWORK OPTIMIZATION [1]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.

Thesis Objectives

Taking into account the current networking trends and the interests of hosting group, We intend to design and implement a SDN-oriented global network optimization algorithm.
This algorithm will use flow steering techniques to deal with the increasing data traffic and will be applied on an SDN[1] architecture where the end-terminals will be 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: OpenFlow, NetFlow, sFlow.
  ◦ Remote terminal configuration protocols: SNMP, NetConf, TR-069, OMA LWM2M.
  ◦ Statistics collection daemons: collectd, 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 (June 2016)

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 (March 2017)

Objectives

Based on data collected by the Rice Efficient Computing Group from Rice University using real users that have been traced using the LiveLab methodology, we aim to:

• Discovering and recreating a real AP network.
• Studying the user behavior (used applications, flow type...)
• Predicting the next application a user will launch based on his previous behavior.
• Predicting the rate user will need.
• Implementing the profiler in the AP assignment component in the controller.

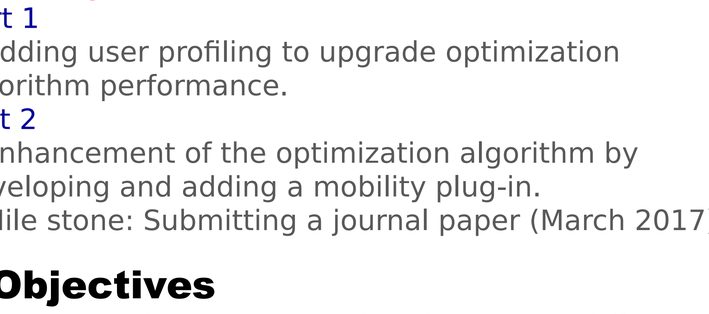

Fig1: Rice Efficient Computing Group dataset

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Results

Discovering a real AP network

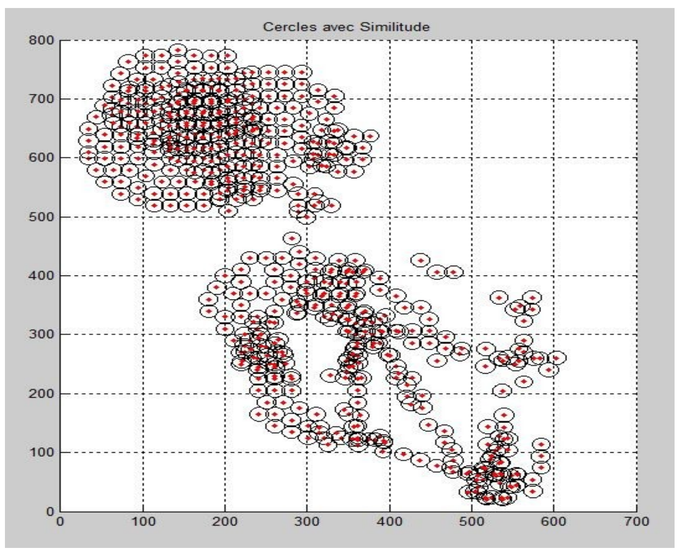

Fig2: Discovered network

Based on the movement of the terminals, the resulting AP network contains 583 APs covering an area of 700×800 meters.

user behavior

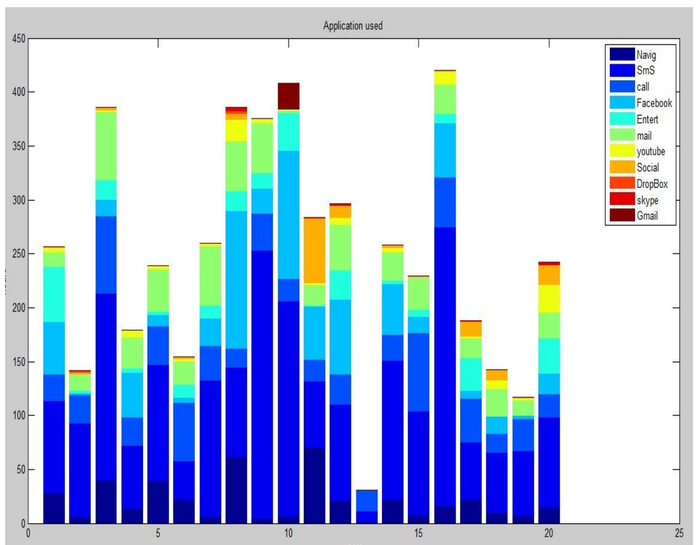

Fig3: Applications used in 1 year by 20 users

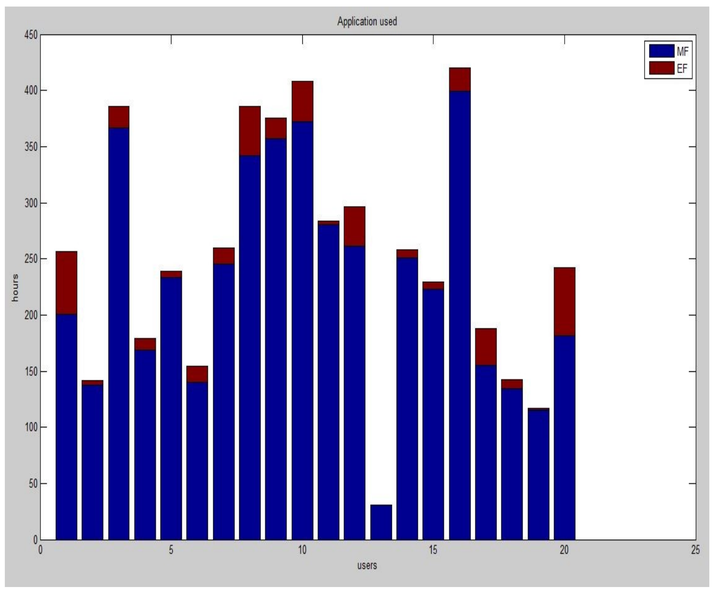

Fig4: Type of flow used in 1 year by 20 users

Predicting the next application/type of flow

Trqining	Approachs	Predection	
3 Days	Approach 1	Application	76%
		Flow	79%
	Approach 2	Application	84%
		Flow	86%
	Approach 3	Application	84%
		Flow	96%
	Approach 4	Application	84%
		Flow	86%
3 Monthss	Approach 1	Application	62%
		Flow	63%
	Approach 2	Application	62%
		Flow	63%
	Approach 3	Application	61%
		Flow	63%
	Approach 4	Application	62%
		Flow	63%

Fig5: Next application prediction

• Approach 1: This approach assigns probabilities to the applications based on for how much long time these applications are usually used at that time of day.
• Approach 2: This approach counts the transitions between the applications The next application is the application that appear most frequently after using the current application.
• Approach 3: Approach 2 plus also taking into account application usage history (the past 4 days).
• Approach 4: Mix of the previous ones, it also takes into consideration application usage probability and time of the day of application usage.

Implementing the profiler component for AP assignment in the controller.

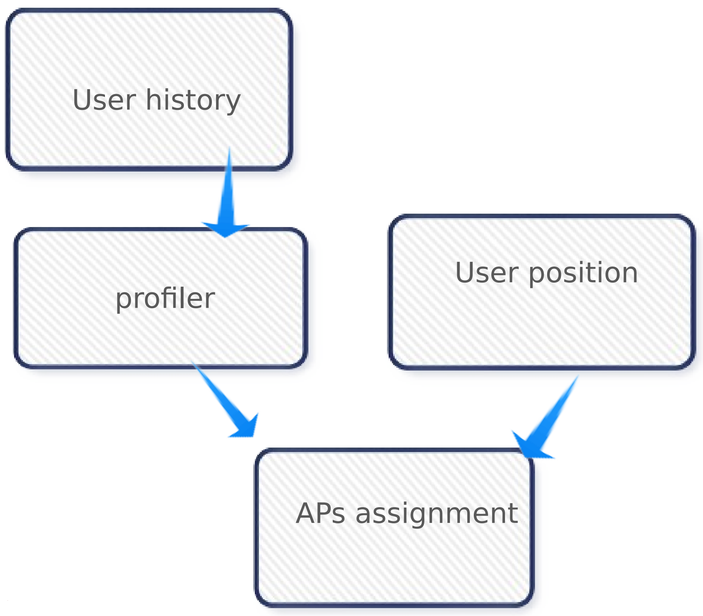

Fig 6 : Controller architecture

Current work

[1] Implementing and testing the user profiler on the network.
 Preparing an article to submit to IPIN 2016.

References

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