A Mobile Platform Traffic Generator for Network Performance Evaluation

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Abstract- This work in progress paper presents an overview of the development of an efficient and accurate mobile traffic generator based on an open source computer-based traffic generator software. A high performance mobile traffic generator would simplify the evaluation of the quality of networks deployed in remote areas. The motivation for this software is to ease feasibility testing and monitoring in the field particularly in rural areas by using affordable and lightweight technology such as a mobile device. Furthermore, a mobile system is more suitable than a personal computer (PC) or laptop in a rural area where the deployment of computers is difficult and impractical. To conduct the research, both an experimental and a simulation research methodology will be applied and the method of investigation will combine methods such as laboratory experiments, document analysis and a literature survey.

Index Terms—Simulation for management support, Mobility, Mobile Apps, Internet Performance.

I. INTRODUCTION

The spread of technology and, more particularly, the availability of cheap mobile phones with WiFi capabilities have increased the interest in evaluating the quality of service (QoS) for voice over Internet Protocol (VoIP) and video data streaming services provided by WiFi networks to this devices. As mobile communication networks constantly evolve, the demand for VoIP and multimedia services have increased gradually [1]. For this reason, the load on networks has increased and the latencies incurred might not be small enough to satisfy the required QoS for new services. This is especially true for long range and mesh networks that may be deployed in rural areas. As a result, the measurement and prediction of wireless network performance are difficult and challenging and must include the study of traffic patterns [2].

The generation of network loads is an essential aspect of network research such as to measure the performance of networks [3]. For evaluation, an actual network, an emulated network or a model of a network can be used. Models are partitioned into simulation models or analytical models. As technology advances, more complex network architectures are deployed and their traffic characteristics make the development of analytical models more difficult [4].

It is important to simulate network traffic to provide information about the expected behaviour of a network before its deployment, which may influence the network architecture chosen to achieve a predefined QoS. The simulation of traffic is also helpful for network analysis and performance evaluation as well as for testing QoS in terms of throughput, latency, jitter and percentage of packets loss.

Considerable work has been done in order to generate realistic network traffic patterns to assist with performance prediction, including D-ITG [4], MGEN [5], and Harpoon [6]. However, little has been written about mobile-based traffic generators, i.e. generators that run on a mobile device that can be used to evaluate network performance in the field. A mobile version of a traffic generator on an Android platform exists but does not offer a rich variety of traffic sources and cannot simultaneously generate multiple flows [7]. This paper describes an attempt to address controlled mobile generation of TCP, UDP and RTP and measure QoS.

II. METHODOLOGY

The main purpose of this project is to develop a new tool that will allow a network administrator to evaluate the performance of networks in remote areas where the deployment of computers or dedicated traffic generators would be difficult and impractical. The proposed software should ease feasibility testing and monitoring in the field using an affordable and lightweight mobile device that can be charged by in situ solar panels or a vehicle where grid electricity is lacking. In Mankosi, a rural community in the Eastern Cape of South Africa where the tool will be tested, a wireless mesh network has been deployed to support local communication at a low cost, including the provision of facilities for locals to charge mobile phones [8]. Thus the existing research infrastructure can power the new tool and provide a network on which to generate and measure traffic. The tool will allow generating different patterns of traffic, deterministic and randomize, and using implementations of most common transport protocols like TCP and UDP. It will also allow implementation of simultaneous traffic flows in order to emulate real user behaviour.

To conduct the proposed research, both experimental and simulation research methods will be applied, combining methods such as laboratory experiments, document analysis and a literature survey. The system will be designed and deployed in the laboratory before being tested in the field.

III. RELATED WORK

To simulate traffic, an appropriate traffic model should be defined to accurately represent relevant statistical properties of real traffic. In this sense, traffic models should be able to be used to generate synthetic but realistic traffic [2][9]. Some traffic generators tools such as D-ITG offer modeling and simulation of a wide variety of traffic sources while others such as RUDE/CRUDE [10] are restricted to the generation of a limited range of traffic sources.

MGEN [5] provides IP network performance tests and measurements of TCP and UDP/IP traffic by generating real-time traffic patterns so that a network can be loaded in a variety of ways. The generated traffic can also be received and logged for analysis. RUDE/CRUDE [10] can deal with

the accuracy limitation of MGEN. RUDE (Real-time UDP Data Emitter) is a small and flexible program that generates traffic to the network, which can be received and logged on the other side of the network with CRUDE (Collector for RUDE). However, RUDE/CRUDE can generate and measure only UDP traffic. NTGM and TrafficEmulator are other tools that enable generation and monitoring of IP/ICMP/TCP/UDP packets from client to server but they only run on the Windows platform.

In order to offer a much larger variety of traffic source models and to improve the generation performance, Avallone *et al.* developed D-ITG that allows generation of network traffic (ICMP), transport layer traffic (TCP and UDP) and many types of Layer 5-7 traffic, including HTTP, FTP, TELNET, SMTP, DNS, VoIP, Video and NNTP [4].

Recently, Botta *et al.* developed a new version of D-ITG for generation of realistic network workload over real networks [3]. The tool offers several improvements by implementing both trace-based and analytical-based approaches, as well as their combination. It can replicate workloads at different layers (flow, packet and application). It works distributed for large scale scenarios and allows repeatable and comparable experiments.

Sommers *et al.* developed a tool called Harpoon for generating packet traffic that has the same characteristics as traffic observed at live routers [6]. Harpoon is a flow-level traffic generator for router and network testing. Their approach is to abstract flow-level traffic generation into a series of application independent file transfers that use either TCP or UDP for transport. Their motivation was to build a tool capable of generating a range of network traffic that might be observed either at the edges or core of the Internet.

This section has mentioned numerous computer-based traffic generator tools. It is not an exhaustive list, yet all are PC-based. So far, little has been developed for a mobile platform. Camacho developed a mobile Android version of a traffic generator that can emulate four different types of data traffic (videos, websites, online games and Skype) in three different environments (Android device emulator, Wi-Fi and 3G network) [7]. It can compare the results between them to see how traffic types empirically behave using each of the connection types. However, the application has a number of limitations [7]:

- The range of statistics is restricted and complex traffic types cannot be simulated.
- Multiple flows cannot be generated simultaneously.
- Traffic cannot be sent at the same time to one single device from more than one mobile phone, i.e. various sender devices transmitting to different ports of one receiver device.
- One phone cannot host multiple traffic types so phones host only one traffic type each.

IV. Conclusion and Future Work

According to the reviewed literature, it is clear that more research is required in the area of mobile-based traffic generators. For this reason, the aim of this project is to provide remote in-the-field feasibility testing of wireless network performance by developing a new traffic generator software package on an Android platform. This includes the provision of a suitable touchscreen interface for the generation and simulation of complex traffic sources. The limited screen resolution (and real estate) as well as the limited computing power of mobile devices make the development of such a system challenging. The literature survey indicates that the next step is to define an appropriate stochastic process that can be used to model and generate realistic patterns for VoIP and video streaming traffic on a mobile device. A prototype of the system will be tested in the laboratory before being deployed in an actual rural communication network in Mankosi.

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