Characterisation of mobile data usage in township communities

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Abstract— **The paper describes a measurement study of mobile Internet usage in township communities in South Africa. The idea is to understand usage pattern of mobile data that would motivate the provisioning of a localised cloudlet infrastructure with an appropriate set of services.**

***Keywords*— cloud computing, wireless, availability, social media integration, synchronization, Internet measurements**

I. Introduction

The penetration of mobile phone technologies in Africa is considered to be a major booster of economic development and emancipation of people living in underprivileged communities [1]. However, as it is often the case, those communities are often served by low quality Internet access, most of the time coupled with expensive connectivity rates. This situation does not encourage the extensive use of Internet technologies that would allow communities to freely communicate, share content and have access to online educational material [2].

The purpose of this project is to understand Internet usage in townships and develop a set of localised cloud services that can leverage community-based infrastructure rather than depending on costly Internet connectivity. The cloudlet platform will be made up of a selected list of open source tools: a file sharing application, an instant messaging service and a social network application. Figure 1 shows the cloudlet infrastructure and the links to a global cloud for data redundancy and synchronisation.

II. Background and Motivation

Mathur et al. studied the mobile users' data usage practices in South Africa. They found that unlike in more developed regions, when data is capped or expensive, users tend to adopt a more cost-conscious approach to reduce the consumption of their data bundle and airtime [2]. The authors used a mixed-method study by using the MySpeedTest application on Android devices, a survey and a semi-structured interview, from which they triangulated the data collected to present statistics.

Chen et al. recently analysed the pricing effects on mobile data usage and observed increased usage for some applications that were zero-rated by mobile operators. They also studied the top most used mobile applications and social media platforms were found predominant in South Africa [3].

The aim of the study is therefore to understand whether an alternative solution in the form of a localised cloudlet platform as opposed to conventional Internet cloud services would help bring down the cost of communication, thereby encouraging the use of Internet-related services for local communication, file sharing and content generation.

To achieve this goal we need to provide an efficient localisation of services and content at the edge networks, easily accessible, reliable and that would cater for the needs of the community.

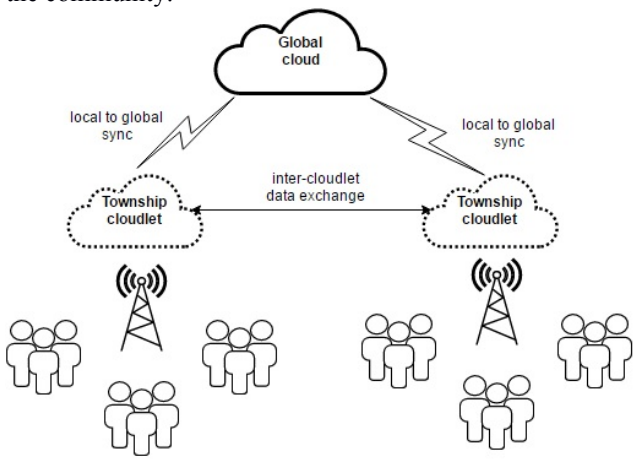

Figure 1. Cloudlet infrastructure

III. Procedures and Methods

The idea is to investigate how much traffic is being generated for social media, VoIP communications, messaging, software updates, video streaming, etc. Mobile Internet is available through different media: pay-as-you-go services (2G/3G/LTE), free public Wi-Fi, paid Internet at Internet cafés, local free community wireless and zero-rated services from some providers [4].

Additionally, we also want to find out how economic factors affect mobile data usage, and how the usage and Quality of Experience (QoE) is influenced by different connection medium. The experiment is therefore two-fold: quantitative measurements will be done using the MySpeedTest application [5] and semi-structured interviews will be carried out to collect data on behavioural aspects such as 'preferred' application. The idea is to cross-verify behaviours of users collected from the measurement application as opposed to the responses received from the survey.

Surveys will be done using the Google forms application. Forms will be filled with responses from high school students conveniently selected by the researcher in the township community. The data collected will help us get information

about the most preferred application, preferred network connection type, most preferred usage of mobile Internet services, amount of money spent monthly on data bundle/airtime and finally the percentage of social media contacts residing within the same locality.

IV. Expected Outcome

Based on some preliminary measurements we obtained from the measurement study, we are planning to provision the cloudlet infrastructure with the open source alternatives of the most commonly used applications. The services will be freely accessible after registration on a secure platform. The following applications will be deployed:

1. *OwnCloud*: is an open source file sharing utility that allow users to store and share files in different formats. It has a client application that users need to install on their smartphones [6].

2. *Diaspora*: is a decentralized social network (DSN) platform and therefore can be installed on private cloud. The servers, called "pod" can be interconnected with one another building a truly decentralized network [7].

3. *Signal*: is an open source private messaging application that can be used as an alternative to the proprietary Whatsapp from Facebook. It provides end-to-end encryption for instant messaging and voice calls are protected.

The system is expected to give a compact and resilient cloudlet ecosystem that enables file sharing and social networking. The localised cloud will itself enable users especially in the township areas to have free access to a means of communication. The file sharing system and the DSN application must integrate sufficiently to increase usage of the cloudlet application by the community. The expected features of this system will be:

- A secure cloudlet for file storage and sharing
- An end-to-end private encrypted messaging service
- An efficient VoIP calling service
- A peer-to-peer method of sharing of files that would ensure constant data availability, even in cases of cloudlet failure.
- An intelligent synchronisation technique between cloudlets and a central cloud, catering for nomadic users moving from one cloudlet to another.
- A decentralized social network platform integrated with other file sharing application, which would also provide connections to other social media platforms such as Facebook and Whatsapp.

The preliminary results, as mentioned above would give an early indication of the direction in which Cloudlet-based services should be delivered. However, as we are collecting more measurements, especially from different township communities, we are expecting to see other usage trends that can influence the design of the localised cloudlet.

Ultimately, using principles such as participatory design to help build a localised network that would cater for the needs the local communities is to be considered.

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