

Leveraging Facebook's Free Basics Engine for Web Service Deployment in Developing Regions

Siddharth Singh*
IIIT-Delhi
siddharth14105@iiitd.ac.in

Vedant Nanda*
IIIT-Delhi
vedant15114@iiitd.ac.in

Rijurekha Sen
MPI-SWS
rijurekha@mpi-sws.org

Satadal Sengupta
IIT-Kharagpur
satadal.sengupta.nit@gmail.com

Ponnurangam Kumaraguru
IIIT-Delhi
pk@iiitd.ac.in

Krishna P. Gummadi
MPI-SWS
gummadi@mpi-sws.org

ABSTRACT

In this paper we analyze Facebook's Free Basics program, which provides free Internet access to a restricted set of web services. As the program grows to 60+ developing countries, an independent and data-driven audit of its scope and outreach is highly relevant to the ICTD community.

We provide the first large scale empirical observations on how content providers are using the Free Basics platform and what kind of user traffic is expected once a Free Basics service goes live. Implementing an Android app for data collection and recruiting participants from 15 countries, we analyze the current set of Free Basics services and their growth over time. We also deploy our own Free Basics services to gather first hand experience about Facebook's gate-keeping procedure in the program. One of our services Bugle News, an RSS news feed aggregator offered in English, Spanish and French, attracted 95.6K unique visitors from 55+ countries since Sep 2016. This enables us to characterize the nationality, demographics and interests of this Free Basics user population.

We specifically deploy an ICTD related Free Basics service called Awaaz: My Voice. Awaaz is a web-service, where citizens can report local issues with location and images. This citizen journalism portal has attracted several hundred users during its short two months deployment in ten cities across South Africa. Visitors have reported concrete issues in categories of road, electricity, water, health and sanitation, school and education, crime and others. Overall our experimental observations allow the ICTD community to understand how Free Basics works and our deployment experiences pave the way for other applications to be launched in future, geared towards important use cases the ICTD community cares about.

*Both authors contributed equally to the paper.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

ICTD '17, November 16–19, 2017, Lahore, Pakistan

© 2017 Association for Computing Machinery.

ACM ISBN 978-1-4503-5277-2/17/11...\$15.00

<https://doi.org/10.1145/3136560.3136568>

CCS CONCEPTS

• **Networks** → **Network architectures**; • **Social and professional topics** → **User characteristics**; • **Information systems** → *World Wide Web*;

KEYWORDS

User characterization, Computing for development

ACM Reference Format:

Siddharth Singh, Vedant Nanda, Rijurekha Sen, Satadal Sengupta, Ponnurangam Kumaraguru, and Krishna P. Gummadi. 2017. Leveraging Facebook's Free Basics Engine for Web Service Deployment in Developing Regions. In *Proceedings of ICTD '17, Lahore, Pakistan, November 16–19, 2017*, 11 pages. <https://doi.org/10.1145/3136560.3136568>

1 INTRODUCTION

Free Basics is a Facebook program, deployed in 60+ developing countries across Asia, Africa, Central and South America [1]. Facebook, in collaboration with particular cellular providers in these countries, offers a set of zero-rated web services. These services are accessible through a mobile browser by typing in the Free Basics url¹ or through the Free Basics Android app [2]. Subscribers of these cellular providers can access the zero-rated web services without incurring any data charges. Facebook claims that their goal is to bring more people online for free and potentially bridge the "digital divide" [3] in these developing countries.

As the target population of the Free Basics program falls within the ICTD community's research interests, our goal in this paper is to improve the transparency of this program. Independent of the publicity of the program by Facebook and concerns raised about the program, we aim to do an empirical data-driven audit as third party independent researchers. We seek answers to the following key questions covering three different aspects of the program:

- **Free Basics services:** Which services are currently part of the walled garden of Free Basics? Do all participating countries have the same set of zero-rated services or are there local variations? Are these offered services growing in number and variety over time? The answers can potentially be useful to the ICTD community to understand the level of participation by local and global developers, offering services to the Free Basics users.
- **Free Basics users:** What is the number of visitors that a typical Free Basics service can expect? From which countries and

¹<http://0.freebasics.com>

demographic backgrounds do these visitors come? The answers can potentially be useful to the ICTD community to understand the level of participation by Free Basics users.

- **Positive aspects of the program:** In presence of the concerns expressed against the program, namely Facebook's gatekeeping, lack of data privacy and violation of net neutrality, are there any positive aspects of the Free Basics program that the ICTD community should be aware of? The answers can potentially be useful to the ICTD community in leveraging such positive aspects to enhance the community's outreach.

To answer these questions, we use the following experimental methodology.

Android app for service list collection: We implement an Android app to scalably collect Free Basics service lists across countries and over time. We recruit participants in 15 countries across Asia, Africa, South and Central America, who collect these service lists using our Android app. We collate these lists and analyze the number, topics, temporal rate of growth and overlap across countries of the offered services.

Free Basics services for visitor data collection: We deploy our own web services Bugle News (an RSS news feed aggregator) and Learn Basics (a high school text book aggregator), as part of Free Basics. This gives us first hand experience with Facebook's approval and service deployment process. It also allows us to collect data about visitors who use our services and characterize their numbers, interests, countries and demographic backgrounds.

Free Basics service relevant for ICTD: We deploy a third web service called Awaaz, specifically to evaluate the relevance of the Free Basics platform to the ICTD community. Awaaz is a citizen journalism portal, where users can report civic and social issues.

Based on the empirical data and its analysis, the following are the key findings in this paper:

- There are currently 200-450 Free Basics services across countries. Most of them are country-specific, and they have grown by 100-150 new services between May 2016 and January 2017 (Section 3).
- Services need to be submitted to Facebook to be included in Free Basics. But this gate-keeping process by Facebook is fast and mostly checks for technical conformity of the content. Our experience while deploying our own Free Basics services has been highly positive (Section 4).
- One of our Free Basics services Bugle News attracted 95.6K unique visitors across 55+ countries, from Sep 2016 to April 2017. This gives a lower bound on the number of Free Basics users, as only a fraction of them would visit our site. We characterize the nationality, demographics and interests of these visitors (Section 5).
- Several hundred users visit Awaaz within a short period of its two months deployment across ten South African cities. They report concrete issues in different categories like traffic, road, water, electricity, school and education, health and sanitation, crimes and others. We present the non-trivial implementation of this service due to Facebook's technical restrictions [4] and list the reported issues, with hopes of discussing actionable items with the ICTD community (Section 6).

We discuss the implications of our findings in Section 7, with respect to some of the Free Basics debated topics and conclude the paper in Section 9.

2 RELATED WORK

Our approach extends prior work in service and user measurements in developing regions; revealing new insights into the state of Free Basics and its implications for users, content providers, and policy makers. Below we detail several related studies.

Free Basics analysis. In our prior work [5], we did a preliminary analysis of the available Free Basics services by manually collecting the service lists. In this paper, we scale the experimental methodology using an Android app instead of manual data collection. App based automation enables us to monitor available free services across countries over time, in both English and local languages and across different cellular providers. This method is similar to other network measurement prior works which use Android apps for scalable measurements [6, 7].

We also use new experimental methodology by deploying our own Free Basics services. This enables us to gather a sample of actual Free Basics users, to enumerate them and characterize their demographics and interests. A subset of our deployed services have been used in another of our prior works [8]. [8] uses the services for fine-grained network analyses to make the Facebook proxy architecture more transparent. It sheds light on lower QoS that Free Basics services experience compared to paid services, as both Facebook and the cellular providers throttle free access bandwidth. This paper, in contrast, uses our deployed services to analyze Free Basics users and their interests. We also present a new service called Awaaz, to demonstrate the relevance of this program to the ICTD community.

Network measurement in developing regions. Several recent studies have explored network performance issues in developing regions. For example, some studies found that DNS servers and a lack of good caching infrastructure are the primary causes of poor performance in some regions [9, 10]. Another study has shown CDN server placements and routing protocols as primary performance bottlenecks [11]. There have been works on building low cost network infrastructure (e.g., using long distance WiFi [12] and software cellular base stations [13]), developing low cost data communication channels (e.g., using SMS or voice) [14], deploying specialized web proxies for developing countries [15], and customizing applications for low-end feature phones [16, 17]. Our work falls in this broad category, but focuses on the previously unexplored Free Basics program. We also focus on the content and user side of the program in this paper, in contrast to [5], which focussed more on the network QoS aspects of Free Basics.

User surveys on zero-rated programs. Chen et al. [18] surveyed users' general interests in zero-rated programs in some developed and developing countries. However, they do not measure Free Basics. Also our user analysis has been done from the vantage point of a web server, while Chen et al. [18] did client side measurements and surveys, which is complementary to our approach.

Information collection and dissemination in developing regions. Finally, the ICTD community has focussed for a long

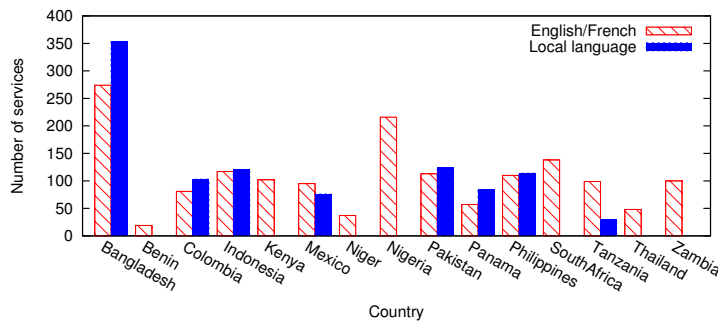


Figure 1: Number of Free Basics services in different countries offered in English, French and local languages

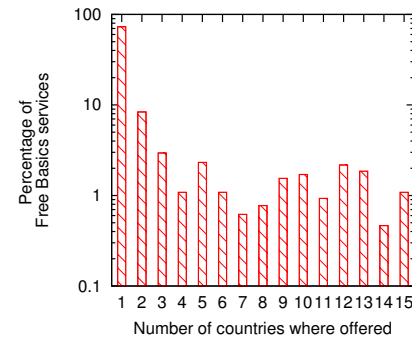


Figure 2: Overlap of Free Basics services across countries

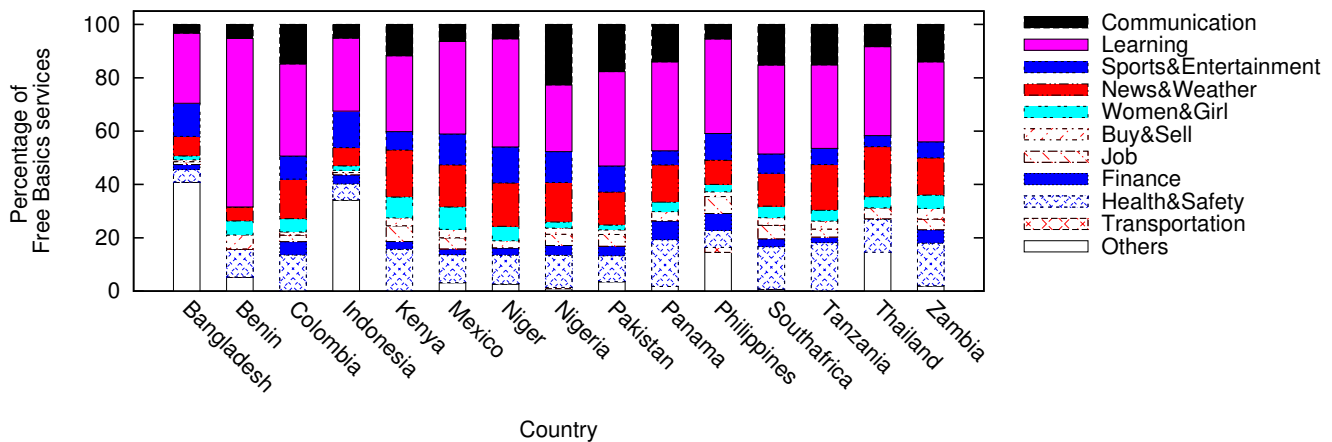


Figure 3: Topic categorization of Free Basics services in different countries.

time on collection and dissemination of information among under-privileged communities in developing regions. They have explored the use of existing technologies like interactive voice response systems (IVR), community radio systems, mobile phones and apps, DVDs etc., to increase the outreach of researchers and field practitioners among developing region populations [19–25]. Facebook Free Basics is another technological intervention in these geographical areas, on which we deploy two web services for information dissemination and one for information creation and collection. Thus our methods fit in with the broad ICTD research agenda of examining existing technologies while exploring community outreach.

3 FREE BASICS SERVICES

The set of services offered in Free Basics differs by country and language, and there are no public listings to inform the contents of the so-called “walled garden” of zero-rated services. Thus, to measure service availability across countries one needs to deploy software that accesses Free Basics from participating cellular providers in those countries. In this section, we describe our automated method for service listing using an Android app, and also present subsequent analyses on the data thereby collected.

3.1 Data collection methodology

We built an Android app, that opens the Free Basics website and crawls through the service lists in available languages. We recruited participants in fifteen countries - five in Asia (Bangladesh, Indonesia, Pakistan, Philippines and Thailand), three in South and Central America (Colombia, Mexico and Panama) and seven in Africa (Benin, Kenya, Niger, Nigeria, South Africa, Tanzania and Zambia). Each participant got some remuneration to cover the expenses of the Free Basics SIM card in their respective country and as a service charge to run our Android app and send us the collected service lists over their normal Internet connection.

3.2 Number of services

Figure 1 shows the number of services offered in different countries. Benin and Niger have services offered only in French. Kenya, South Africa, Tanzania and Zambia have services offered only in English. The rest of the countries have services offered in two languages: English and a local language like Spanish in Mexico, Bahasa in Indonesia and Kiswahili in Tanzania². Bangladesh and Nigeria have the highest number of services, exceeding 200, while the median is

²Though Thailand has services offered in the local Thai language, our collected data did not have this service list.

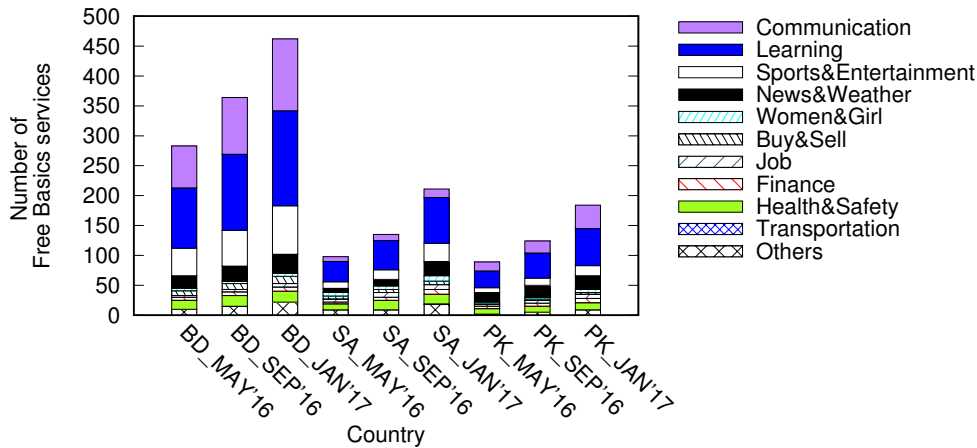


Figure 4: Histogram of Free Basics services and topics over time in Bangladesh (BD), Pakistan (PK) and South Africa (SA).

around 100 services across the countries. Local language offerings are as many or more than English offerings, except for Tanzania.

Figure 2 shows number of countries where a particular service is offered. A small percentage of services are offered in more than one country. AccuWeather, BBC News, Bing, Baby Center, Girl Effect, Thesaurus, Watsapp and Wikipedia are some services offered in all fifteen countries, so this is probably a common list of services that the Free Basics program in any country starts with. But 80% of the services are offered only in one or two countries. This observation and the high number of offerings in local languages, indicate that local web service developers in a country are using the Free Basics platform to offer services customized for their country in their local language.

3.3 Topic of services

Figure 3 show the proportion of Free Basics services in different countries categorized into ten topics. The Free Basics landing page lists these ten topics and lists 2-3 services under each topic heading. The rest of the services are shown as a long list, without any topic categorization. We manually categorized all the services offered in English (and in French for Benin and Niger), using the service name and the one line service description. Some services did not match any of the ten topics and have been listed as "Others".

Learning, News&Weather and Health&Safety are the dominant topics in most countries. An interesting observation is, other than in categories Communication (which has some instant messaging services and social networking service like Facebook) and Buy&Sell, almost all services are textual websites giving information on the concerned topic. This is true even for topics like Sports&Entertainment, where more than interactive games and live audio or video streaming, there are news articles in sports and entertainment categories. Thus the web services are dominantly textual, providing news and information on a variety of topics.

3.4 Temporal evolution of services

Figure 4 shows the number and type of English-language services offered in Bangladesh (BD), Pakistan (PK) and South Africa (SA) over time. The x-axis shows the country and time, while the y-axis

shows the number of listings. Between the nine months of May 2016 to January 2017, Bangladesh has added 179 new services, while South Africa has added 113 and Pakistan 95 during the same period.

In summary, the contents of the Free Basics “walled garden” vary depending on the country (but not on the ISP in a country), are growing rapidly, and are dominated by information services such as education, news, and health. We further find that only a small number of services are offered in more than one country. The deployed services are highly customized in each country, with 80% of the observed services offered only in one country (and ~20-30% offered only in local languages).

4 DEPLOYING OUR OWN SERVICES

To understand the service-provider view of Free Basics, we developed our own web services and deployed them on the Free Basics platform. We can use the services as vantage points to study the server-side architecture of Free Basics and study the Free Basics users who visit the sites. Table 1 specifies the time periods of data collection for each service. The functionalities of two of our services are described below and the third service will be discussed in detail in Section 6.

Service Name	Start Date	End date
Learn Basics	Jul'2 2016	May'6 2017
Bugle News	Sept'17 2016	Apr'10 2017
Awaaz: My Voice	March'13 2017	May'6 2017

Table 1: Time periods of data collection for each service

4.1 Web service details

Bugle News. We built an RSS aggregator service called Bugle News that fetches RSS feeds from news organizations including BBC, CNN, and Reuters, and provides users with corresponding headlines/ledes. The news stories are organized by topic and country. Users using Bugle News would see these news snippets aggregated from different sources, categorized into eight high level topics (World News, Africa, Asia, America, Science, Sports, Movies&Entertainment

and Jobs&Career). There were additional lower level topics for nine countries: South Africa, Zambia and Nigeria within Africa; Philippines, Bangladesh and Pakistan within Asia; and Colombia, Peru and Mexico within America; and two specific sports: Cricket and Football within Sports. The service was offered in English between September 17th and December 15, 2016 and has been available in English, French and Spanish since December 16, 2016.

Learn Basics. We built an educational service called Learn Basics, that publishes free English-language and Mathematics educational material made available under the Creative Commons license. The material was originally offered as PDFs; however, because Free Basics does not zero-rate PDF content we converted the content to images displayed as HTML. This service has been offered in English since July 2, 2016.

4.2 Deployment Process

We listed our services using the standard Free Basics application portal. This entailed submitting our service URLs and descriptions of what each service offered. When prompted to specify the countries in which to deploy our service, we requested them to be included in all countries where English is used or understood. We later added countries supporting French and/or Spanish for Bugle News.

Facebook provided feedback within a few days of applying and approved the services within 2 weeks (2 days after submitting Learn Basics, 14 days after submitting Bugle News). Their feedback was strictly technical, requesting removal of Javascript elements to conform to the Free Basics technical guidelines [4]. After deployment Facebook responded to technical support questions within one week. They also sent a Quality Analysis email to inform us of downtime when the Learn Basics website became temporarily unavailable due to a server failure.

In summary, though Facebook plays a "gatekeeper" role in Free Basics, we found no evidence of any barriers for legitimate content to appear in the program. Further, Facebook lists services alphabetically in every case that we observed, indicating that services are not otherwise prioritized. Thus, all evidence points to Facebook playing a neutral "gatekeeper" role and providing reasonable technical support for service deployments.

5 CHARACTERIZING THE VISITORS

In this section, we use our deployed services to characterize the Free Basics users who visit our sites in terms of where the users are located, how they interact with our sites, and their demographic information. We leverage the fact that Free Basics users visit our site via a Facebook proxy server [4, 5] that sets the "x_forwarded_for" HTTP header that indicates the mobile IP address of the Free Basics user. This allows us to geo-locate the users to a country based on the cellular provider's registered address. We associate visited content with unique users by setting browser cookies that are unique to each user. Last, we use the Facebook developer portal analytics demographic information that anonymously reports statistics about visitors' age and gender.

5.1 Visitor dynamics

The number of daily Learn Basics visitors range from 300-500, while those for Bugle News range between 800-1,200. Although we do

not have evidence to identify why Bugle News is more popular, we posit that rank on the service listing ("Learn Basics" appears lower in the listing alphabetically) and content relevance (news is more popular than educational reference material) are contributing factors. Given the relative popularity of Bugle News, we focus only on this service in the subsequent analysis.

Figure 5 shows the daily Bugle News visitors since deployment along y-axis with time along the x-axis. We confirmed that the number of visitors reported from Facebook's developer portal match the same recorded at our server. We see the number of requests from the Free Basics app is small and relatively constant over time, and the vast majority of visitors use a mobile web browser to access our service.

We use rectangles to highlight interesting events in Figure 5. The left box shows a Free Basics service outage resulting in a sharp drop in traffic in September³. There is a sharp spike on the day after the result of the US presidential election in early November (the middle box). In the right box, we highlight initial increases in number of visitors after the launch of French and Spanish versions of Bugle News in December. The drops in visitors in the right box correspond to widely celebrated holidays on Dec 24th, 25th and 31st. This increase in visitor numbers, with introduction of new languages, has been sustained over January to April.

Figure 6 shows an empirical cumulative distribution function (CDF) of the number of days each user visits the site. The x-axis is the number of days, x , a user visits, with the y-axis representing the fraction of users who have visited a site at most x days. We see that a majority of users are transient, with 78% of the users visiting Bugle News only once and 98% visiting us over less than 5 days. Thus, user retention of Bugle News has been low.

Fairly high number of daily visitors (Figure 5) and low user retention (Figure 6) means a large fraction of hits are from unique visitors. We counted 95.6K unique visitors to Bugle News overall. Interestingly, even with zero promotional efforts, a reasonably practical Free Basics service can see nearly 100K visitors in a short period. This gives a ballpark lower bound on the Free Basics population size, as only a subset of them would visit Bugle News (given many competing news services including BBC itself).

5.2 Visitor demographics

Figure 7 shows the age distribution of overall Free Basics visitors and those for Bugle News and Learn Basics. Figure 8 shows the gender distributions for the same. These numbers are extracted from the Facebook developer portal.

Learn Basics has a higher proportion of younger visitors and a more even male-female gender ratio than Bugle News and Free Basics. This can possibly be attributed to the high-school level educational content of Learn Basics, which appeals to younger people and equally across genders.

While such demographic information is potentially useful for a service provider when tailoring to its audience, it is unclear how Facebook determines these numbers. Neither the Free Basics user portal nor our services ask for user demographic information. It is an open question whether Facebook is using the Free Basics

³Learn Basics saw the same sharp drop and we verified with Facebook that this was a service outage.

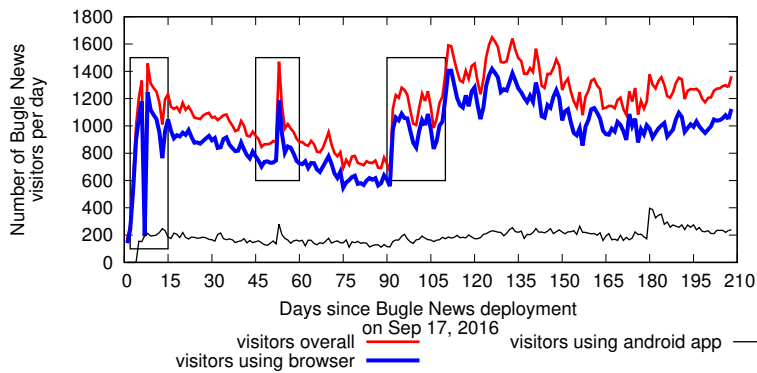


Figure 5: Daily Bugle News visitors, showing the impact of a Free Basics outage (left box), the US election (middle box), and deployments in multiple languages (right box).

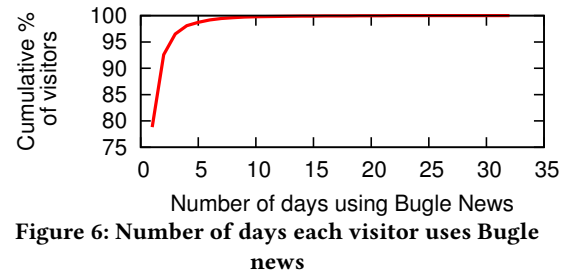


Figure 6: Number of days each visitor uses Bugle news

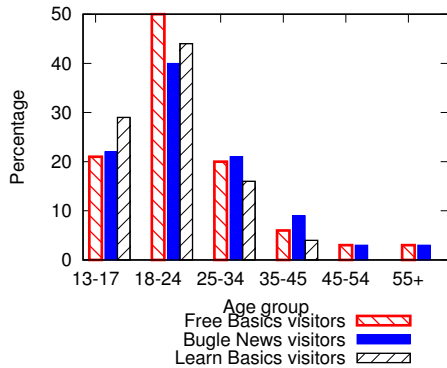


Figure 7: Fraction of visitors for Facebook-reported age groups.

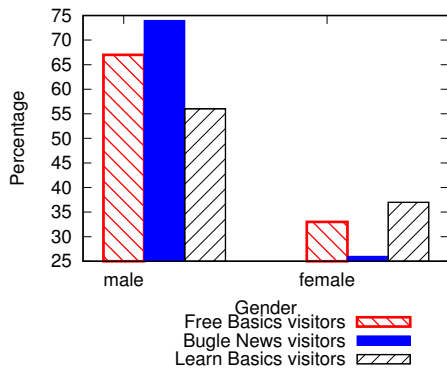


Figure 8: Fraction of visitors for Facebook-reported gender.

visitors' self-declared information on the Facebook social network (also available as a Free Basics service), using information from cellular providers, or something else, and whether this information is always accurate.

5.3 Visitor countries

Figure 9 shows the visitor countries along x-axis and the average number of Bugle News clicks per day from that country along y-axis (log scale). We divide the time since Bugle News deployment into two periods: the service initially offered only in English (3 months) and later in English, Spanish and French (4 months). The x-axis is sorted from left to right by countries, from which the highest number of requests were received during both measurement windows.

Bugle News has received visitors from 56 countries so far. Mexico (MX), Zambia (ZM), Nigeria (NG), Philippines (PH), Pakistan (PK), South Africa (ZA), Iraq (IQ), Bangladesh (BD) and Thailand (TH) and are some of the countries with highest number of requests per day.

After introducing French and Spanish support, requests have increased from countries like Benin (BJ), Mauritania (MR), Madagascar (MG), Gabon (GA) and Republic of Congo (CG). These are the higher black bars on the right side of the plot. We can attribute this to the colonial French past of these African countries, making French one of the official languages there.

5.4 Visitor interests

Figure 10 shows the proportion of users (along y-axis) in eight countries (along x-axis) requesting specific news feeds on Bugle News. The patterns in the bars denote the 18 different news feeds that Bugle News currently offers.

World, Entertainment and Career are some of the popular categories across all countries. Cricket is popular in Pakistan and Bangladesh while Football (i.e., soccer) is popular in the American and African countries. Finally, all countries show strong affinity for geographical proximity. The proportion of requests for the country's specific news feed is high, while visitors show almost zero interest for other countries. These insights are useful for web service developers, to understand the importance of including location specific content, even if they offer their service in more than one Free Basics country across the world.

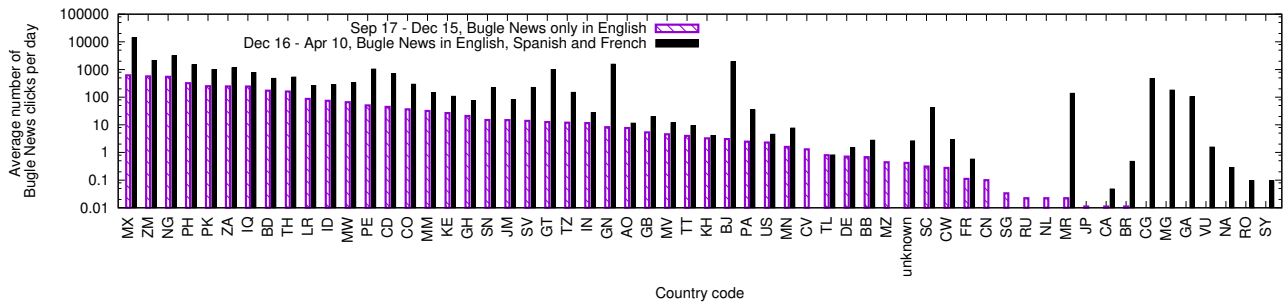


Figure 9: Proportion of countries among Bugle News visitors, before and after adding French and Spanish languages.

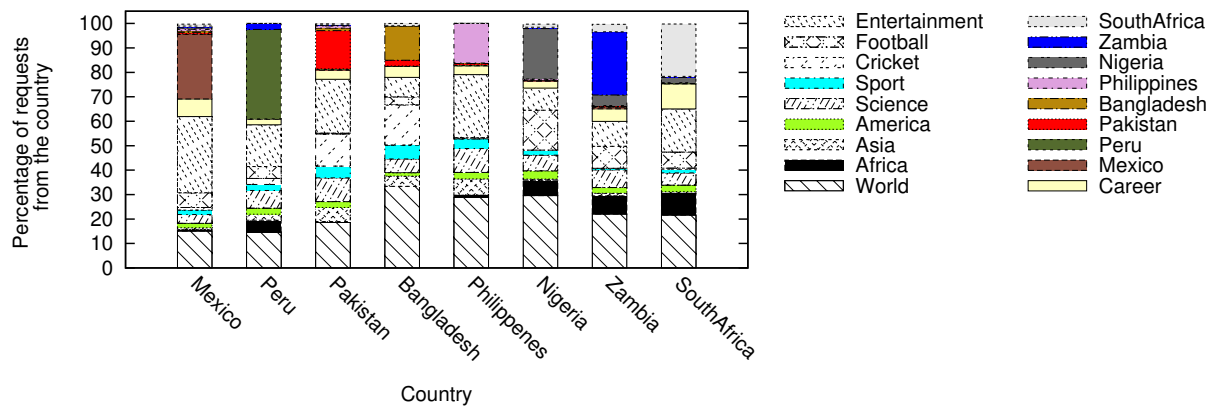


Figure 10: Proportion of 18 news topics accessed from 8 countries. Bugle News has specialized news feeds for these countries.

5.5 Visitor suggestions

The final set of interesting observation came from the "community suggestion" tab of Bugle News, which provides a form to suggest RSS feed URLs and the corresponding news feed where to add that RSS feed. The form optionally asks for the visitor's name and email address. We got 57 suggestions in this page, 47 of them with email addresses and 6 having legitimate RSS urls. The email addresses can potentially be useful for targeted surveys of Free Basics users, about their experience with the platform. Among suggestions, some asked for internet services like "google.com", "applestore.com", "youtube.com", indicating that these people have heard about these popular websites and want to access them, though these are currently unavailable in the walled garden of Free Basics. Lastly, some suggestions included personal phone numbers, though the form never asked for it. This shows the possibility of some users unknowingly leaking sensitive information on the platform.

6 CITIZEN JOURNALIST: AWAAZ

To leverage the Free Basics platform and reach out to its unique user population, we launched our third web service called "Awaaz: My Voice" in Free Basics. We submitted this service to Facebook on March 5, 2017 and it became live on March 13, 2017. In this section, we discuss the goals and design for this service and user inputs obtained so far, to highlight how Free Basics can be used to create rich user generated content in the developing regions.

6.1 Service goals

The goal of launching "Awaaz" is to crowd-source information about civic and social issues in developing countries. There are many such examples of citizen journalism mobile apps and web services [26, 27], where the user generated inputs are useful to understand pain points and possibly connect issues to relevant authorities. We have seen good hits for our preliminary services Bugle News (a news aggregator service) and Learnbasics (a textbook aggregator service). With that confidence we launch Awaaz, which is our first service to actually create some valuable content, harnessing the Free Basics platform.

6.2 Technical design

To support lower end feature phones prevalent in the developing countries, Facebook imposes certain technical restrictions [4] in Free Basics web services. For example, Javascript or location detection in the mobile browser (needs HTML5 support) cannot be used. Incorporating third party modules within Free Basics services is also difficult, if the third party service is not part of Free Basics, causing users to be charged for accessing it. For example, showing a Google Map to take map-based user input is not feasible, as that needs Javascript support and Google content is not included in Free Basics. This walled garden of Free Basics, along with the technical restrictions, make the technical design of Awaaz non-trivial.

As reporting an issue has to be associated with a geographic location to have any meaning or potential of redressal, we use a drop-down list of municipal blocks in a particular city that users can

Location, Title: Description
Uphongolo, Rosendal, Bridged electricity : We have a problem of people who bridged electricity ,there are lot of them and now electricity bill is high on people who did not bridge
Mafikeng, Majemantsho, shutting down off the electricity without a notice : Mine we experience shutt down of electricity continuously about 2 days in very week.This affect us in a way that our goods are being waisted because they use electricity.school children are can't go to school because its winter now they can't bath with cold water and crime rate is high.
City of Johannesburg, Johannesburg, we need electric in our community : Plz someone help us coz we don't get service delivery in our community since from 1991 I was born here but every counsellor come with empty promises

Table 2: Issues reported in category "Electricity"

Location, Title: Description
City of Cape Town, Kraaifontein, Teenage Pregnancy : Well I have been looking around my community I get to see that we have teenagers with HIV and I feel bad for them but this isn't though sex only bt children are The reason is that people don't have the basic information or the right information we get to see that if someone instead find that you HiV they run away from you the question is Why? ?its because they don't have the right information some believe that by touching a person you can get HIV but No.People are even ashamed to go get tested by Shoprite cause their will be a lot of people standing around and possible you will feel ashamed if they shout out your results they even I sometimes blame the parents cause they dont look after their children and the When children often realize they have this illness they believe they can do nothing but is that TRUE??
Mkhondo, Driefontein, MR : Here we have an apolo but it has never lighted ever since it was built. Shops here most of them are owned by indians and when you buy a sim card you may find it surprising that it has been Ricad without your IDNUMNER. And this might make things a little bit harder for police officials to trace someone who have committ Cleaning service is poor! We need an upgrade. MKHONDO has a huge number of unemployed youth but when you walk through the streets, it is disgusting how dirty are they. My suggestion was that if the municipal manager can just employ the uneducated youth to clean up the place it will be better for it atleast it would h And lastly I need a government built house. My room is not healthy but I would be assisting the community in creating an health environment for all. I am in the faculty of buit environment so it my duty to apply what I learnt and create a healthly and safe environment of our people.

Table 3: Issues reported in category "Health and sanitation"

Location, Title: Description
City of Johannesburg, Soweto, Nsfas busarys @ tvet colleges : George tabor the after life of high school for many black kids who didn't have the privilege of going to varsity ,its also a second chance to many who wish to have a better future . This college mostly funded by the national students fund is sitting on a time ticking bomb from student who are not happy about the handling of their funds and the way the college is responding to their complaints , the government issue busarys for every student and allowance for every month but for students in George tabor its jst news they see on the media yet other college My question is this as a student how im i suppose to pay back money i didn't see nor use ,don't u think this is one of the reasons nsfas is struggle to get money from students because they never use it nor enjoy its benefits jst'sayin
Mkhondo, Driefontein, mr : I am Phakathi Zenzele. A second year Electrical engineering student at University of South Africa(UNISA). I need Internet access be stored near me and I would like it to be a community based Internet access so that other people can use it. I don't mind to be an administrator of it because I will be using it to communicate with lectures and some module needs more time on Internet. And also to assist other learners who have just finished school to make applications for higher education. It will be helpful if just feel it
Mkhondo, Piet Retief, Unemployed : Can you just imagine a graduate with Bsc in Chemistry end up doing nothing the whole day having no work to do? . That is unbelievable education must be challe And do you consider the number of students in tertiary taking out the loans to pay the fees while other graduate are just chilled with the qualification at homes? It makes no sense
City of Cape Town, Bellville, Unfinished qualification : Can you please mayors and other city officials assist this student. He was studying Analytical Chemistry at Tshwane University of Technology. On his second year things didn't work out for him to make it to third year level due to some issues. And he left with few modules to complete and now he's stuck. And all this now course him to have some unusual behaviour and is now suspected of having some mental illness Please assist! Also the department of higher if it could please help. He scored very good marks both in Physics and mathematics and what is happening now is not he giving any sense to young schoolars who are still at school. Th His contacts xxxxxxxxxx. <i>This issue has been reported three times.</i>

Table 4: Issues reported in category "School and education"

Location, Title: Description
Cederberg, Cederberg NU, terrible roads : in chatty we hv a issue of our gravel road whn it rains its a disaster and tht makes it impossible for vehicles to pass bcz the others get stuck and this grauel road is the main road we really do need help wit this thank you
Emakhazeni, Belfast, Mr : Roads at Belfast have a lot of potholes.

Table 5: Issues reported in category "Roads"

Location, Title: Description
City of Johannesburg, Roodepoort, mr dn mothibi : I Dikabelo Mothibi residing at georgia Roodepoort. My complain is the place we stay at. we don't have water. Landlord she stole electricity. room leaking when it raining my furniture it get wet. I loose my job because it was raining then I been absent at work. to protect my furniture. I need help pls. My contact number is xxxxxxxxxx. <i>This issue has been reported three times.</i>
Polokwane, Polokwane, help us with water : Our people can spend two to three months without water and this is bad because some of our people have to buy water from people who have boreholes in their homes.there are those who have water tanks in their homes and their water can last longer,so those with no water tanks suffer a lot because sometimes they don't have enough money to buy water,water tanks or bore their own boreholes.

Table 6: Issues reported in category "Water"

select from. They can optionally give the full address of the location that has the issue, manually typing it in a text box. Users can select from seven categories of issues from a second drop-down list: roads, transportation, electricity, water, health and sanitation, school and education and others. They need to describe the issue in a text box and solve a captcha, before they can click the "Report" button. They can also optionally upload a small image (size restriction imposed by Facebook [4]), that demonstrates the reported problem. Figure 11 shows an app screenshot.

Figure 11: Screenshot of Awaaz issue reporting page. Users can select a municipality in South Africa from a drop-down list, a category for issues from another drop-down list, give a title and description of the issue, give a full address for the issue (optional), upload a small image (optional), solve a captcha and submit the issue.

When users visit the Awaaz web service for the first time, they need to enter their name, city and optionally their phone number. The backend server associates a browser cookie, and stores these information for the user. This allows to load the appropriate drop-down list of municipal blocks for the particular city, on subsequent visits by the same user. Awaaz also includes a link where users can see issues reported so far, categorized by topics or by location. Each issue in this feed has an option to add comments, so that users can reinforce, negate or discuss issues reported by others.

6.3 Issues reported so far

In two months of Awaaz deployment with support for ten South African cities, we have seen 713 unique visitors who came to our service using Free Basics. 274 unique users among the visitors

registered with their name, city and phone numbers in the landing page. A total of 34 issues have been reported. Tables 2- 7 list a subset of the unique issues reported in different categories of "Electricity", "Health and sanitation", "School and education", "Roads", "Water" and a set of miscellaneous topics⁴.

Some issues have been reported multiple times (specified in the tables). In some cases, the user has expressed an interest to be part of the solution process, if possible (see the last entry in Table 3 for an example). While all reported issues should ideally reflect the ground reality in South Africa, some of these are also verifiable using independent news stories from the period of data collection. The first column in Table 4, for example, is representative of the "Fees must fall" movement [28], an ongoing protest by college and university students against South African government policies.

6.4 User interactions so far

To evaluate users' interactions with the web service interface and iteratively improve the design, we have launched Awaaz only for ten most populous South African (SA) cities. The official language of SA is English, which helps us in prototyping and seeing user interactions more easily. The level of English comprehension has been better in Awaaz compared to a similar form we have for Bugle News URI suggestions (Section 5.5). There have been however some misunderstandings, for example, in the "Title" field of the issues, some visitors entered "Mr/Mrs/Miss" i.e. their own gender based title, instead of a specific title for the issue. The average time spent by a user in the landing page to register is 122 seconds and to report an issue is 151 seconds. To understand UI issues in more detail, we plan to do a user survey in near future using the registered phone numbers.

6.5 Future enhancements

Some enhancements planned for the service in near future are:(i) identify and correct UI design issues, (ii) launch the service in more cities in SA and gradually to other Free Basics countries, and (iii) add support for more languages. Potentially, this can create a unique opportunity to compare civic, social and other reported issues across 60+ developing countries. The collected user interactions data will also be valuable from an HCI research point of view. Finally, connecting the service to the relevant authorities will be needed, as done by similar services in the past [26, 27], so that the reported issues have a potential of getting redressed. We seek to identify such possible actionable items and increase our connection with field practitioners, with help from the ICTD research community.

7 IMPLICATIONS

The Free Basics program has grown substantially, but has also created controversy with strong opposition from proponents of an open Internet [29, 30]. In this section, we discuss the implications of our measurements in the context of these concerns and discuss possible ways to leverage the positive side of this platform.

Gate keeping by Facebook. In our experience of deploying Free Basics services, the feedback that we received from Facebook

⁴An updated list of all reported issues is maintained at http://myvoice.mpi-sws.org/all_reports.

Location, Title: Description
City of Cape Town, Cape Town, Hunger children: Lots of children sleep without food in they stom.ach so I like to help them
Ethekwini, Botha's Hill, NO EMPATHY FOR THE COMMUNITY: Issue is the lack of local government support and funds. I have combined the youth together to create better stay for all, my aim is to uplift young people, sma Environmental issues and animal rescue. I have land to fulfill this aim, and I want to open a skills development centre. I need government to meet us halfway. Its fully registered
City of Cape Town, Cape Town, BRING BACK DEATH PENALTY: A girl was murded in the area where i live her name was (<i>text truncated</i>). I just want to say that The police never do their jobs properly when they wanted to search the man who murded her's house he was the only one who said you need to have a search warrent. Everyone else agreed for them to search their places. Her body was found in his shack. (<i>text truncated</i>) She use to be friends with his daughter. How sick isnt this man. Please HELP THERE MUST BE NO JUSTICE FOR RAPIST AND FOR KILLERS. They cannot get away with it every single time he had no heart when he took a young girls life why must we have a heart for him. Our children has no childhood they cannot even play with their friends because a sick person is always watching their every move. This is not fair the polic Always just want to lock them up please NO!!!!!! JAIL IS STILL TO NICE FOR THEM BECAUSE THEY ARE BEING PROTECTED BUT THAT GIRL WAS NOT PROTECTED. (<i>text truncated</i>).
City of Cape Town,Belhar, about jobs the killing on the street the drugs: When will the justice be served in this world
Mangaung, Mangaung, South Africa police service: On wednesday i was beaten by two guys around 5 O'clock and i called the SAPS to solve my case and they came after and left me when go to those guys, after few minutes they came back without those guys and they arrested me as victim who is reporting the assault case and they locked me until 1 O'clock at night and they fine me R250 and leave me walk at night alone. My question is that: is police still doing their job to protect the community or in business with criminals because i really dont understand what i was arrested for.
Mamusa, Mamusa [Schweizer-Reneke] NU, mrs: our youth are not working.unemployment is high in manusa
City of Cape Town, Kommetjie, polce complain: about police station in ocean view.bad service no order no hardworking people at that station half of them don't understand your complaint always just one police van available...what is happening in our community.
Sol Plaatjie, Kimberley, emtee stole my song: Emtee stole my song "we up"
City of Johannesburg, Orange Farm, Miss: Please help us to build the shopping centre around this area. We are struggling a lot
Phumelela, Warden, renovation of sports ground (stadium): the is a renovation of stadium at ezenzelini, that was speculated worth 5m according to chief whipped of ANC hence what we see is not even worth 2m. our municipality got clean audit while the is corruption we don't get services. we did a marsh on December 2016 and we were arrested on 9 January 2017 for enquiring the premier to answer our memorandum.

Table 7: Issues reported in category "Others"

has been strictly technical. Our overall experience has been very positive, as discussed in Section 4. One point to note is all our services lack controversial content. Bugle News aggregates news, Learn Basics provides text books and Awaaz is a citizen journalism portal. There have been reports expressing censorship concerns about the program [31], and also about governments trying to exploit Facebook's role as the gatekeeper for surveillance [32]. Thus it is not clear whether our positive experience with Facebook's gate-keeping can be generalized to all services.

Data privacy from Facebook. Our deployment experience validates Facebook's advertised architecture of a proxy network [4]. Requests came to our web servers from IP addresses that we could map to Facebook data centers, using traceroute/whois utilities. An interesting observation we made in the context of privacy was the age and gender demographic information given at the Facebook's developers' portal. How Facebook computes these numbers, though neither the Free Basics website nor our services explicitly ask for user information, is an open question. Some transparency in this regard will be good to ensure users' knowledge about collecting and sharing information about them. Finally, users giving away their mobile numbers on this platform should be educated about the privacy implications.

Leveraging the positives aspects. Analyzing the currently deployed Free Basics services (Section 3), we find some excellent services on health, education, social awareness, news and other topics. Such services aimed at information dissemination often do not need data privacy from Facebook. They can be simple textual sites, without a need for advanced features like Javascript or rich multimedia that are not allowed for Free Basics websites. Such services can also be deployed in a way that their content consumes

small amounts of data and is relatively insensitive to bandwidth caps, which Free Basics services are subjected to ([5, 33]).

We found that even a simple RSS feed aggregator service on Free Basics can get close to 100K unique visitors, as we experienced with Bugle News. We also found with Awaaz, that visitors spend time to report concrete issues on a variety of topics, showing the potential of generating useful datasets leveraging the Free Basics platform. We seek to discuss the specific issues reported in Awaaz with the ICTD community, to identify possible actionable items and increase our connection with relevant field practitioners. Thus creative ideas to harness the positive aspects of the Free Basics platform has the potential to advance many research objectives, targeting user populations in 60+ developing countries.

8 FUTURE WORK

Our findings so far provide opportunity for deeper inspection of certain key observations. Data privacy risks for inexperienced Internet users, might be one direction. Exploring how Free Basics service providers can make the users more aware of the sensitive information they are revealing about themselves, might be useful. Another direction might be examining popular web apps currently absent in Free Basics, to see how the technical restrictions function in the face of feature-rich, flexible content addition necessary to support such apps. Thirdly, if the technical restrictions indeed force the Free Basics apps to be text heavy, it is necessary to study the implications for the millions of non-literate users of the Internet in developing countries that Free Basics targets. Finally, connecting Awaaz users to field practitioners will be a necessity to keep the platform alive. In that process, analyzing how reporting via such a platform works with the socio-political realities of public service in developing nations, will be interesting to explore.

9 CONCLUSION

This paper seeks to understand that in presence of many downsides which are completely or partially valid about the Free Basics program [5, 8, 33], how can one positively harness this platform in locations where it is already available? Our prior works [5, 8, 33] and this paper, taken together, present a balanced audit of this platform, a vital necessity to complement the opinion based Free Basics debates raging in the news and the social media. Our experience in this paper shows that ICTD services targeted at developing region populations can potentially benefit from such a platform, that increases the outreach of the world wide web. Such services aimed at information collection or dissemination might not need data privacy from Facebook and also not use a lot of bandwidth. They can therefore potentially tolerate the negatives of the Free Basics architecture, analyzed in our prior works [5, 8, 33]. Our experience report of deploying three different Free Basics services will hopefully give more transparency into this platform and encourage other ICTD researchers and practitioners to consider whether the platform can benefit their cause and research agenda.

REFERENCES

- [1] Where we've launched - internet.org. <https://info.internet.org/en/story/where-weve-launched/>.
- [2] Free basics by facebook - android apps on google play. <https://play.google.com/store/apps/details?id=org.internet&hl=en>.
- [3] Digital divide. https://en.wikipedia.org/wiki/Digital_divide.
- [4] Technical guidelines - free basics. <https://developers.facebook.com/docs/internet-org/platform-technical-guidelines>.
- [5] Rijurekha Sen, Hasnain Ali Pirzada, Amreesh Phokeer, Zaid Ahmed Farooq, Satadal Sengupta, David Choffnes, and Krishna P. Gummadi. On the free bridge across the digital divide: Assessing the quality of facebook's free basics service. In *Proceedings of the 16th ACM Internet Measurement Conference (IMC)*, 2016.
- [6] Yuanjie Li, Chunyi Peng, Zengwen Yuan, Jiayao Li, Haotian Deng, and Tao Wang. Mobileinsight: Extracting and analyzing cellular network information on smartphones. In *Proceedings of the 22nd Annual International Conference on Mobile Computing and Networking (Mobicom)*, 2016.
- [7] Ashkan Nikravesh, Hongyi Yao, Shichang Xu, David R. Choffnes, and Z. Morley Mao. Mobilyzer: An open platform for controllable mobile network measurements. In *Proceedings of the 13th International Conference on Mobile Systems, Applications, and Services (MobiSys)*, 2016.
- [8] Rijurekha Sen, Sohaib Ahmad, Amreesh Phokeer, Zaid Ahmed Farooq, Ihsan Ayyub Qazi, Dave Choffnes, and Krishna P. Gummadi. Inside the walled garden: Deconstructing facebook's free basics program. In *Computer Communications Review*, 2017.
- [9] Zachary S. Bischof, John P. Rula, and Fabián E. Bustamante. In and out of cuba: Characterizing cuba's connectivity. In *IMC*, 2015.
- [10] Yasir Zaki, Jay Chen, Thomas Pötsch, Talal Ahmad, and Lakshminarayanan Subramanian. Dissecting web latency in ghana. In *IMC*, 2014.
- [11] Asheesh Sharma, Manveen Kaur, Zahir Koradia, Rahul Nishant, Sameer Pandit, Aravindh Raman, and Aaditeshwar Seth. Revisiting the state of cellular data connectivity in india. In *DEV*, 2015.
- [12] Rabin Patra, Sergiu Nedeveschi, Sonesh Surana, Anmol Sheth, Lakshminarayanan Subramanian, and Eric Brewer. Wildnet: Design and implementation of high performance wifi based long distance networks. In *NSDI*, 2007.
- [13] Abhinav Anand, Veljko Pejovic, Elizabeth M. Belding, and David L. Johnson. Villagecell: Cost effective cellular connectivity in rural areas. In *ICTD*, 2012.
- [14] Aditya Dhananjay, Ashlesh Sharma, Michael Paik, Jay Chen, Trishank Karthik Kuppusamy, Jinyang Li, and Lakshminarayanan Subramanian. Hermes: Data transmission over unknown voice channels. In *MobiCom*, 2010.
- [15] Xiao Sophia Wang, Arvind Krishnamurthy, and David Wetherall. Speeding up web page loads with shandian. In *NSDI*, 2016.
- [16] Akhil Mathur, Shivam Agarwal, and Sharad Jaiswal. Exploring playback and recording of web-based audio media on low-end feature phones. In *ACM DEV*, 2013.
- [17] Agha Ali Raza, Mansoor Pervaiz, Christina Milo, Samia Razaq, Guy Alster, Jahanzeb Sherwani, Umar Saif, and Roni Rosenfeld. Viral entertainment as a vehicle for disseminating speech-based services to low-literate users. In *ICTD*, 2012.
- [18] A. Chen, N. Feamster, and E. Calandro. Exploring the walled garden theory: An empirical framework to assess pricing effects on mobile data usage. In *Communications Policy Research South (CPRSOUTH)*, 2016.
- [19] A. Vashistha, E. Cutrell, and W. Thies. Ivr junction: Deploying social, scalable and distributed voice forums in the developing world. In *ICTD*, 2013.
- [20] A. Moitra, V. Das, A. Kumar, Gram Vaani, and A. Seth. Design lessons from creating a mobile-based community media platform in rural india. In *ICTD*, 2016. digitalgreen. <https://www.digitalgreen.org/>.
- [22] Gramvaani. <http://www.gramvaani.org/>.
- [23] Carl Hartung, Yaw Anokwa, Waylon Brunette, Adam Lerer, Clint Tseng, and Gaetano Borriello. Open data kit: Tools to build information services for developing regions. In *ICTD*, 2010.
- [24] Z. Koradia, Balachandran C, K. Dadheech, M. Shivam, and A. Seth. Experiences of deploying and commercializing a community radio automation system in india. In *ACM DEV*, 2012.
- [25] D. Chakraborty and A. Seth. A participatory video and audio platform for community interaction using dvds and ivr systems. In *ACM DEV*, 2013.
- [26] Bcity: Bengaluru government observatory. <http://bengaluru-government.mapunity.com/>.
- [27] Meri awaaz. <https://play.google.com/store/apps/details?id=com.meriawaaz.mygap&hl=en>.
- [28] The successes and failures of south africa's student movement. <https://wagingnonviolence.org/feature/south-africa-fees-must-fall/>.
- [29] Opening internet.org and free basics: An open letter to facebook. <https://openmedia.org/sites/default/files/openmedia-facebook-freebasicsletter.pdf>.
- [30] Anita Gurumurthy and Nandini Chami. Internet governance as 'ideology in practice' - india's 'free basics' controversy. *Journal on Internet Regulation*, 2016.
- [31] Facebook's free basics is an african dictator's dream. <http://foreignpolicy.com/2016/10/27/facebook-plan-to-wire-africa-is-a-dictators-dream-come-true-free-basics-internet/>.
- [32] Egypt blocked facebook internet service over surveillance. <http://www.reuters.com/article/us-facebook-egypt-idUSKCN0WY3JZ>.
- [33] Siddharth Singh, Vedant Nanda, Rijurekha Sen, Sohaib Ahmad, Satadal Sengupta, Amreesh Phokeer, Zaid Ahmed Farooq, Taslim Arefin Khan, Ponnurangam Kumaraguru, Ihsan Ayyub Qazi, David Choffnes, and Krishna P. Gummadi. An empirical analysis of facebook's free basics. In *ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*, 2017.