Community Network Music Sharing System

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ABSTRACT

The creation of music, specifically Hip-Hop, is common in low income areas in South Africa. These are areas beset with poverty and a lack of resources. Due to this, residents in these areas face bandwidth constraints and thus face difficulty connecting to the internet and sharing files, specifically media files such as songs. This review covers the core aspects of this problem, such as the inaccessibility of data in these communities, the means of connection to the internet in these areas and the ways in which media is currently shared in these areas. Conventional media sharing trends are explored as well as the functionality of a community owned network in Ocean View, Cape Town that offers affordable data rates for the residents in this low-income area. Additionally, the importance of music in these areas is highlighted by the exploration of the content of the songs and the core themes they address.

CCS CONCEPTS

• Networks • File Sharing

KEYWORDS

Community Networks, Bandwidth Constraints, Hip-Hop

1   Introduction

The ability to share music is a fundamental aspect in the creative process followed by musicians. It allows them to spread their message, create a name for themselves and earn an income. [13] Despite a lack of resources in low income areas, musicians still find many ways to share their music, such as: Bluetooth, WhatsApp and peer-to-peer file sharing websites. [3, 4, 6, 7] Conventional means of music sharing are inaccessible in low income areas due to data constraints. [7] YouTube, Soundcloud, Spotify and Apple Music are data intensive applications, thereby posing challenges for bandwidth constrained users who have limited mobile data and no regular access to WiFi. [6, 7]

Not only is music sharing a core aspect of a musician's creative process, but it is an important vehicle for addressing issues within society. For many Hip-Hop artists in South Africa, music is a means to address the socio-economic disparity that is so prevalent in the country post-apartheid. [8, 10]

The goal of this literature review is to assess previous work and contextualise the problem of a music sharing system on a community network in South Africa. This review will explore the existing and most widely used global music sharing applications, the data constraints faced by people in low income areas in South Africa as well as how they access the internet, the common online and offline music sharing mechanisms used in low income areas in South Africa to mitigate the high costs of conventional music sharing applications, the importance of music sharing in low income communities in South Africa and the structure and opportunities offered by a community owned network in addressing the afore mentioned issues and topics.

The aim of this project is to create a music sharing system on the iNethi network, a community-owned wireless network [9] located in the low-income area of Ocean View in Cape Town, that will allow artists to share their music with the people around them in an easy, cost effective and data-efficient way.

2   Data Constraints and Internet access in Low Income Areas

2.1   Mobile Data Usage in Low Income Areas

Mobile data usage in low income areas in South Africa is limited due to the high cost of data relative to the income in these areas and variable coverage, resulting in low quality connections. [2, 11, 12] This is the main way in which the internet is accessed in these areas as WiFi networks are not readily available to the public. [12]

More than 50% of South African households have a monthly income of less than R1600. [2] When compared to the cost of data bundles it is to see why people are faced with bandwidth constraints.

Table 1. Data Plans from Mobile Operators [2]

Operator	Option 1	Option 2	Option 3	Option 4
MTN	5MB 1 day, R4	20MB 1 day, R12	50MB 3 days, R25	300MB 5 days, R85
Vodacom	20MB 1 Day, R5	100MB 1 day, R10	250MB 1 day, R20	250MB 1 month, R60

Cell C	20MB 1 Day, R3	100MB 1 day, R13	100MB 1 month, R25	300MB 1 month, R60
Telkom	25MB 1 month, R8	50MB 1 month, R15	100MB 1 month, R29	250MB 1 month, R39

These issues have resulted in the inability and limitation of people downloading large files. [15] This plays a major role in the limited streaming of music and videos [15] on sites such as YouTube, [2, 6, 7] leading to a different way in which media is consumed. People prefer to download their media, given that it is only a few megabytes, directly to their device so that they can repetitively listen to or watch it and not waste data while streaming. [6]

When it comes to the sharing of locally made music, artists have to be aware of these issues and make special accommodations. In low income areas songs will be extensively compressed by the artists in order for them to be easier to share on the poor connections and use less data. [7]

A free compression software named Format Factory is commonly used to compress files while some other artists use VLC Media Player to compress files. [7] Artists aim for songs to be between 3 and 5 megabytes with roughly about 1 megabyte per minute of audio. [7]

This is beneficial as it reduces data use, but also results in much lower audio quality. However, this does not deter the artists from the use of compression software as it increases the overall probability of people sharing the song with those around them as it will not use significant amounts of data to do so. Additionally, even with a slow connection it will still be possible to send the file.

2.2 Means of Internet Access in Low Income Areas

2.2.1 Internet Access via Phones. Internet access is almost exclusively carried out using a mobile phone in low income areas. [1, 6, 7, 12, 15] Conventional desktop computers are not only rare in these areas, but highly antiquated made up of a myriad of parts from many different machines. [6]

2.2.2 Internet Access via Community Networks. Some low-income areas in South Africa also have access to community WiFi networks which offer access to zero-rated services and general internet access for rates that are lower than mobile data rates.

The iNethi community owned network in Ocean View in Cape Town, South Africa is an example of this. Ocean View was established during Apartheid as a township for people who were forcibly removed from areas such as Noordhoek and Simons Town under the group areas act. It is currently a mixture of formal and informal dwellings and is still an under-resourced community.

The iNethi network was created to not only offer members of the Ocean View community access to cheaper internet, but also encourage content sharing between the people in the community in an area where access to data is limited. [9] Residents of Ocean View have access to a variety of free services and can browse the internet for R10 a gigabyte of data.

It utilizes open-source software to share files and to allow people to communicate, this is done using OwnCloud and Diaspora respectively. [11]

The network provides wireless internet over television white spaces and WiFi mesh, which is accessed at WiFi access points. [9] This creates an affordable and easy to use network that anyone in the community can purchase data for and use freely.

3 Conventional Forms of Music Sharing in the Modern World

A general trend in the world at the moment is the increase in use of streaming music platforms such as Spotify, Apple Music and Deezer. [16, 18] The music world has moved away from purchasing individual tracks and albums online to these streaming services where artists earn a certain amount per stream of their songs. [18] This is advantageous for the consumer as they can have access to millions of songs without having to buy them, but rather pay a fixed price or listen to them for free with ads.

Streaming of music is seen as a substitute for permanent downloads of music. [18] People are moving away from storing music on their phone, which could lead to issues with storage capacity, and rather stream it as they can consume whatever they want whenever they want without worrying about storage capacity.

As mentioned before, these streaming services are offered on either a limited free to use basis or a premium paid version which the users pay a monthly subscription for. [16, 18] The free to use models are funded by advertising and offer limited features, whereas, the premium versions provide on-demand music streaming with no interruptions. [16, 18] These services are offered on both fixed devices and mobile phones, [16, 18] requiring an internet connection as data is used every time a song is streamed.

Spotify and other music streaming services advertise and have been proved to increase music discovery as the user can freely listen to any music they choose to, without having to pay extra. [16, 18] Spotify has been proven to increase the consumption of music, while increasing the variety and discovery of music. [18] They do this by recommending new music to the user constantly and creating daily playlists for the user based off of the music they have added to their library. This makes it beneficial for artists to have their music on these platforms as they have the chance of new audiences discovering them that they would not have had access to in the past.

Before streaming services, music piracy was a popular way to consume music, however, with the introduction of services such as Spotify it has been proven that there has been a decrease in the amount of music piracy. [18]

Music piracy became prevalent as internet connection speeds increased and the cost of storage space decreased. [13] This resulted in the ability to download files of any size and the ability to save them and not have an issue with storage space running out. A significant deterrent of music piracy was the poor audio quality and the fact that files had to be manually organised and moved from device to device. [13] Streaming services allow you to play music on any device by simply logging into your account and offer high quality audio.

A pivotal part of streaming platforms, such as Spotify, are their publication-subscription communication paradigms. [17] This is a system that sends notifications of certain events, such as a song being added to a playlist a user has subscribed to, to end users in real time if they are online and forwards events to offline users when they come online at a later stage. [17] This allows people to follow their friends on the application and see what they are listening to. [16, 17] Thus furthering the users' ability to discover new music. It also encourages people to consume more music as they are kept up to date with what is happening on the application and will open it more frequently to access the newly added songs or features.

In essence these applications all offer their users the ability to stream music wherever they are as long as they have an internet connection. Users have access to millions of songs [18] and can listen to as much music as they want for a fixed amount if they are on a premium plan. [16]

4   Music Sharing in Low Income Areas

There are numerous ways in which music is shared in low income areas in order to circumvent expensive data usage. There are both online and offline means in which musicians circulate their music. [7]

4.1   Offline Music Sharing in Low Income Areas

The major mode of offline distribution is via Bluetooth. [3, 4, 6, 7] Bluetooth is a free to use service that is offered on feature phones, the type of phones that the majority of Hip-Hop artists use. [4] This distribution process starts when the artist transfers their song from a computer, used to produce and edit their song, onto their phone via a USB cable. [4, 6, 7] The artists will then transfer the song to other members of the community and in some cases even hire a young child to walk around their area transferring their song to as many people as possible. [7] This creates an offline distribution network that will hopefully multiply if people like the song and decide to share it with their friends.

Another mode of offline distribution is playing music at communal gatherings in low income areas, such as bars, neighbourhood gatherings and marketplaces. [14] The only issue with this is finding a way to get the music to the people who will play it and then sharing it with interested parties who have heard it as these social events.

4.2   Online Music Sharing in Low Income Areas

One of the biggest issues faced by Hip-Hop artists, according to them, is the difficulty they face sharing their music. [5] They believe a web presence is a means of putting them on an even footing with other established artists and allows them to reach new audiences. [5] Many artists believe it is more important to get people listening to their music than receiving money for it. [5] This is due to the fact that they not only want to share their message but expanding their audience will allow them to have more live shows and get their music into stores, which many Hip-Hop artists in South Africa struggle to do. [5]

Some online modes of distribution require manual input, in a similar way that Bluetooth does, from the artists in order to share their song. The two most popular means of music sharing in South Africa are Facebook and WhatsApp. [5, 6, 7] Manual input is involved with WhatsApp distribution where the artist is required to send people their song manually. The main issue with this is it can become costly when the artist has to send the same song to a large amount of people, thus using large amounts of data. For the end user this process is not costly as it only requires one download and then they have the song for as long as they wish to keep it. This mode of sharing does not require a link to a website for them to download the song but rather the artist can send the file without any third-party assistance.

The use of Facebook is also a popular means of sharing music by Hip-Hop artists in South Africa, but this requires the use of a third-party website for the downloading of the song. The artist will create a post on their Facebook profile and share a link to a website where people will be able to go and download their song. Due to the fact that the majority of the Hip-Hop artists set their Facebook profiles to public it becomes possible to search for their songs via Google and see these posts. [7] This is an important factor in the searchability of their music and offers the artist a digital presence which makes them discoverable to invisible audiences. An invisible audience is one that the artist does not have a direct connection to. [7]

The two most used third-party websites by these artists to upload music to are KasiMP3 and Datafilehost. [7] KasiMP3 is a music distribution website that is aimed at musicians based in low income areas. [7] It was designed for use on feature phones with data constrained users in mind. [7] It allows musicians to create a profile, upload songs, videos, pictures and has many features of a social media website. [7] However, musicians have started having difficulty accessing the site which is believed to be due to latency issues. [7]

Datafilehost is an alternative to KasiMP3 but does not have all the features KasiMP3 offers. It is an anonymous file sharing website that offers an online drop box which musicians can upload a file to without the hassle of logging in, thus reducing the data needed to use the website. [7] It is not searchable, does not have a tagging process and does not offer descriptions for the file uploaded [7] which emphasises the importance of the use of public Facebook profiles to make the music uploaded to this website accessible. Even with all these issues the benefit of low data usage has made Datafilehost extremely popular. Datafilehost also offers a download counter which is important to the artists that use it; however, this has been found to be inaccurate. [7] The artists have no form of analytics other than the download counter. Therefore, it is an important aspect of the website as it allows them to see how large the audience is that they are reaching and which songs they share are the most popular.

Additionally, the file will be deleted from the website after 90 days of inactivity and when accessed from a device with antivirus software there are warnings of malware present on the site. [7]

Table 2. Comparison of Datafilehost and KasiPM3

Feature	Datafilehost	KasiMP3
Purposely designed for feature phones		✓
Minimal data use	✓	
Profiles and song descriptions		✓
Download counter	✓	
Digital persistence		✓

The importance of third-party websites is emphasised by the lack of storage space on phones that many people have in low income areas. [7] This means that people will have to delete songs whenever they wish to download anything new. Thus, a digital persistence is important if people want to have continuous access to the song and be able to download it again at a later stage.

5   The Importance of Music Sharing in Low Income Areas

Music is an important means of communication and a vital tool in spreading ideas in low income areas. South African Hip-Hop is fundamentally different to the commercial Hip-Hop seen worldwide. It aims to challenge gangsterism and the inequality present in the country. [7, 8, 10] This is done by emphasising the importance of morals and ethics while highlighting the racial barriers that are still present in the country.

South African Hip-Hop originated in the 1980s in Cape Town where it was used to challenge the barriers and racial categorisation that were created by the apartheid regime. [7, 8] Many of these themes were inspired by Steve Biko and the Black Consciousness movement. [7] These narrative strands are still present in Hip-Hop today as musicians look to uplift their communities and disseminate positive and motivational messages.

Self-reflection, topical debates on AIDS (Acquired immunodeficiency syndrome) and globalisation are extensively present in the Cape Town Hip-Hop scene. [8] Artists wish to educate and change the way society views these issues using their music as their mode of communication. Not only do artists tackle these socio-economic issues but they aim to encourage their communities to stay away from crime. [8]

These are the core themes of the South African Hip-Hop scene making it an important tool to address and influence the way people in the country treat each other and think about those around them.

6   Discussion

The main method of music sharing and consumption in the modern world is the streaming of songs using mobile data or WiFi. This method of music sharing, and consumption is not a viable option in low-income areas due to their bandwidth constraints and poor connection to the internet. This results in the avoidance of any streaming platform such as YouTube, Spotify and Soundcloud.

The role of music in these areas is still an important means of communication and education, therefore, it is imperative that music is still circulated. This is ensured by the artists, who use unconventional methods to share their songs. They use both online and offline methods to do this. They also focus on ways of sharing music on mobile phones as this is the most common media playing device with an internet connection in these low-income areas.

The main issue faced by artists is the data constraints their audience and themselves face. It is evident that an optimal music sharing platform for low income areas would have to be designed to be phone centric and take into account the bandwidth constraints users would face. There would be a need for some sort of analytics and way of tagging music for searchability, while maintaining a conservative approach to the amount of data these features would use.

This makes projects such as the iNethi community owned wireless network a perfect initiative to tackle this problem as it is located in a low-income area and provides users with data for significantly less than users would pay for mobile data, thus increasing the bandwidth they would have to share and download music.

7   Conclusions

The assessment of data constraints, modes of access to the internet, the methods of music sharing and the importance of music

in low income areas in South Africa has highlighted the need for a music sharing platform that is created with these issues in mind.

This platform can draw from the music sharing platforms that are already used in both bandwidth abundant and constrained environments. The platform would need to possess features that fall under the web 2.0 umbrella but still be designed for feature phones with bandwidth constraints in mind. Designing for feature phones is imperative as that is the most common mobile device used in these areas and is the only way the majority of users will be able to connect to the platform as computers are scarce.

With this platform and the cheaper internet in mind artists would not have to compress their songs as much as they do not have to account for such severe data constraints. This means their music will be shared with a better sound quality. Additionally, a platform like this could provide a stable environment to store their songs and create digital persistence for the artists' work.

Core features that artists would want are a simple text interface so as to avoid unneeded data usage, a download counter so that artists have some form of analytics, a tagging system so that the website is searchable and a simple way to download the file without the need of logging in.

The iNethi network addresses the issues of data constraints and internet connections in a low-income area. This platform and area could be used as a testing ground for a music sharing platform that combines the successful features of KasiMP3 and Datafilehost into one, a site like the one mentioned above.

REFERENCES

[1] T. Kreutzer. 2009. Assessing cell phone usage in a South African township school, Int. J. Educ. Dev. Using Inf. Commun. Technol., vol. 5, no. 5 (2009), 43–57.

[2] A. Phokeer, M. Densmore, D. Johnson, and N. Feamster. 2016. A First Look at Mobile Internet Use in Township Communities in South Africa, ACM DEV '16: Proceedings of the 7th Annual Symposium on Computing for Development., 15 (2016), 1-10. DOI: https://doi.org/10.1145/3001913.3001926

[3] N.J. Bidwell, M. Lamas, G. Marsden, B. Dlutu, M. Jones, W.D Tucker, E. Vartiainen, I. Klampanos, and S. Robinson. 2011. Please call ME.N.U.4EVER: Callback & Social Media Sharing in Rural Africa, Proceedings of the Tenth International Workshop on Internationalisation of Products and Systems, 117-138.

[4] B. Harrilal1, A. Schoon and E. Blake. 2016. Complementing backyard-bedroom recording studios with a mobile app, Proceedings of the 5th International Conference on M4D Mobile Communication Technology for Development, 59-72.

[5] G. Pritchard and J. Vines. 2013. Digital Apartheid: An Ethnographic Account of Racialised HCI in Cape Town Hip-Hop, Conference: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2537-2546. DOI: 10.1145/2470654.2481350

[6] A. Schoon. 2014. Digital hustling: ICT practices of hip-hop artists in Grahamstown, Technoetic Arts a Journal of Speculative Research, 12 (2014), 207-217. DOI: 10.1386/tear.12.2-3.207_1

[7] A. Schoon. 2016. Distributing hip-hop in a South African town: from the digital backyard studio to the translocal ghetto internet. In Proceedings of the First African Conference on Human Computer Interaction, 104-113. DOI: https://doi.org/10.1145/2998581.2998592

[8] H. Becker and N. Dastile. 2008. Global and African: exploring hip- hop artists in Philippi Township, Cape Town, Anthropology Southern Africa, 31:1-2, 20-29. DOI: 10.1080/23323256.2008.11499960

[9] M. Lorini, M. Densmore, J. David S. Hadzic, H. Mthoko, G. Manuel, M. Waries and A. van Zyl. 2019. Localize-It: Co-designing a Community-Owned Platform, Locally Relevant ICT Research, 1-15. DOI: 10.1007/978-3-030-11235-6_16

[10] D. Marco. 2011. Rhyming with "knowledge of self": the South African hip-hop scene's discourses on race and knowledge, Muziki, 8:2, 96-106, DOI: 10.1080/18125980.2011.631303

[11] A. Phokeer, M. Densmore and D. Johnson. 2016. Characterisation of Mobile Data Usage in Township Communities, Proceedings of Southern Africa Telecommunication Networks and Applications Conference, DOI: 10.13140/RG.2.2.36137.80486

[12] S. Hadzic, A. Phokeer and D. Johnson. 2016. Townshipnet: a localized hybrid TVWS-WiFi and cloud services network, International Symposium on Technology and Society., 1-6.

[13] S. Bhattacharjee, R. Gopal, G. Lawrence Sanders. 2003. Digital music and online sharing: software piracy 2.0?, Communications of the ACM, Vol. 46, No. 7, 107-111, DOI: 10.1145/792704.792707

[14] N. Lobley. 2012. Taking Xhosa Music out of the Fridge and into the Townships, Ethnomusicology Forum, Vol. 21, No. 2, 181-195, DOI: https://doi.org/10.1080/17411912.2012.689472

[15] I. de Lanerolle. 2012. The New Wave: Who connects to the Internet in South Africa, HOW they connect and what they do when they connect., DOI: 10.13140/2.1.1391.6485.

[16] L. Aguiar and J. Waldfogel, 2017. As streaming reaches flood stage, does it stimulate or depress music sales?, International Journal of Industrial Organization, Volume 57, 278-307, DOI: https://doi.org/10.1016/j.ijindorg.2017.06.004

[17] V. Setty, G. Kreitz, R. Vitenberg, M. van Steen, G. Urdaneta, and S. Gimåker. 2013. The hidden pub/sub of spotify: (industry article). In Proceedings of the 7th ACM international conference on Distributed event-based systems (DEBS '13). 231–240. DOI:https://doi.org/10.1145/2488222.2488273

[18] L. Aguiar. 2017. Let the Music Play? Free Streaming and its Effects on Digital Music Consumption. Information Economics and Policy, volume 41, 1-14. DOI: https://doi.org/10.1016/j.infoecopol.2017.06.002