

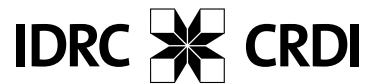
DEVELOPING SMART PUBLIC WI-FI IN SOUTH AFRICA



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ACKNOWLEDGEMENTS

The authors thank those who made themselves available for interviews for the different cases and those who provided comments on the paper including Project Isizwe and Neotel. This research would not be possible without the support of the Canadian International Development Research Centre.



Editing: Liz Sparg

Layout design and images: Karen Lilje

Web layout: Creative Storm

Publication Date: June 2016

EXECUTIVE SUMMARY

South Africa urgently needs innovative solutions to address the digital inequality facing the country. In modern economies and societies, these online inequalities mirror the social and economic inequalities that continue to plague the country 20 years after the end of apartheid. In fact the advent of mobile broadband with the multitude of innovations that have accompanied it, amplifies the inequality between those with the means, finances and capabilities to exercise the rights enshrined in one of the most progressive constitutions in the world, and to harness the economic benefits of broadband and those marginalised from these services in a modern economy and society. Besides issues of inequality, there is growing evidence that a critical mass needs to be connected for the network effects that enhance the information flows and reduce the transactional costs that are associated with enhanced efficiencies associated with economic growth. Further, it appears that the real gains are associated not only with connectivity but the intensity of use, which reflects not only the extent of time online, though this appears to be a good indicator too, but also the range of services used and the activities undertaken with them.

The is arguably the primary policy challenge for African countries. Universal service strategies initially

focused on the development of fixed networks through dedicated universal service levies, proved largely unsuccessful. Efforts to aggregate demand through the creation of telecentres had mixed results, but generally subsidised supply-side driven initiatives had short-lived success or failed. Some centres that were community initiated and generally driven on some form of entrepreneurial or commercially sustainable model worked. But, with the advent of mobile broadband and smart devices, the price and skills barriers that computer-based Internet access created were increasingly removed, undermining the logic of access device aggregation. Mobile devices can now offer adequate user experiences with web browsing, email access, messaging and an increasing variety of applications.

Yet, while increased Internet penetration (with its widening coverage), mobile technology upgrades to 3G (and now LTE), and the affordability of smart devices have combined to increase mobile data uptake, use remains limited. Limited coverage and slow data speeds in outlying areas together with the relatively high cost of services, excludes the poor and inhibits optimal use by most users.^{1,2} The RIA African Mobile Prepaid (RAMP) pricing indices, data prices remain relatively high across the African

¹ Rey-Moreno, C. (2013). "Alternatives for Affordable Communications in rural South Africa". September 2013, Policy Brief. Find at: www.apc.org/en/system/files/Policy%20brief%20Cost%20to%20Communicate_13092016_FOR%20SUBMISSION.pdf

² Stork, C., Calandro, E. and Gillwald, A. (2013). Understanding internet going mobile. Internet access and use in 11 African Countries, Policy Paper 14, Research ICT Africa, Cape Town. Find at: www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_14_-_Understanding_Internet_Going_Mobile.pdf

continent, and South Africa is not in the top third of African performers. Poorer customers who do use mobile Internet usually use it sparingly due to high costs and therefore lose out on many of the benefits of broadband access.

With smartphones increasingly available (even amongst lower income groups) and having the computing power and screen size needed for meaningful Internet use, one promising solution is free public Wi-Fi (FPW). FPW sponsored by the local authority is popular in many Asian and North American cities. Provinces and cities in South Africa are starting to invest in coverage of underserved areas and in their central business districts. The traction with citizens has been overwhelming.

There are various models of public Wi-Fi in South Africa, but in early 2016 only two (Gauteng and Western Cape) have implemented assessable initiatives. These are the wealthiest provinces and are highly urbanised, Gauteng almost entirely. The four largest metropolitan areas: Tshwane, Johannesburg and Ekurhuleni (in Gauteng), and Cape Town (in Western Cape) have projects.

FPW projects typically emanate from authorities with broadband development strategies and with plans in place as is the case in Gauteng and the Western Cape. Most of the FPW plans are connected to initiatives to connect government buildings via fibre networks. FPW, although already on the drawing board in these two provinces in advance of the national

broadband policy, is in alignment with it. SA Connect requires that all public buildings be connected to broadband and that wherever these connections occur they should include a FPW hotspot.

The review of the status (time and cost management) and characteristics (governance, approach to risk) of an authority's fibre rollout as part of the broadband project is likely to correspond with the status and characteristics of that authority's free public FPW project. Wi-Fi projects tend to either piggyback on these fibre deployments (Western Cape, Ekurhuleni, Johannesburg, and, to some extent, eThekweni), or to benefit from existing municipal fibre (Tshwane and Cape Town).

The different approaches to the government-funded Tshwane Free Wi-Fi project and the Western Cape's free Wi-Fi public-private and public community initiatives are the focus of this study. Not only were they already the most advanced at the start of this study, but they also exhibit different approaches, business models and funding arrangements.

The most important findings are contained in the final chapter: Policy-related findings. However, the most important projects, Tshwane Free Wi-Fi and Cape Town/Western Cape, are worth highlighting here.

Of all the projects, Tshwane Free Wi-Fi is the most advanced in terms of scale and impact. The project began in 2013 and has grown in scope, leading to an ambitious vision to embrace all of Tshwane's citizens with a defined basic service. At the heart of the project

has been a can-do chemistry between Tshwane’s mayor and a third party provider (a combined non-profit organisation called Project Isizwe and a network operator called Herotel Telecoms). The project is based on two investment justifications. The first being that broadband is a basic right of every citizen, and should be offered across the country fully funded by government. The second justification is the economic rationale that increased broadband penetration drives economic growth, increases commercial, financial activity that will expand the tax base and which together will exceed the city’s investment. With this rationale, the premise is that public Wi-Fi should be free.

The project is focused on rapid rollout and user

access. There is a sense of urgency both on the side of the city and the implementers, Herotel and Project Isizwe, who have a turnkey approach, including advice to authorities on how to bypass tender processes. Isizwe’s founders invested considerable time and personal financial risk to sell the idea of the project. The results, in terms of network deployment have been impressive, and the content portal and programme to generate local video have illustrated the potential for Wi-Fi and broadband to enhance employment opportunities, health and education and connect government to citizens. In line with SA Connect, the focus has been on connecting educational institutions. All the literature suggests this produces the greatest positive multipliers.

	Tshwane Free Wi-Fi	Western Cape Broadband Initiative
Strengths	<ul style="list-style-type: none"> • Quick deployment • Costs agreed upfront for 3 years • Tried and tested and has demonstrated success 	<ul style="list-style-type: none"> • Open network (fosters innovation, competition and private sector involvement) • Supports private sector investment from the start
Weaknesses	<ul style="list-style-type: none"> • Considered expensive • Not “open access” • Top-down philosophy – users are not regarded as mature, contributing adults • Does not position Isizwe to bid for combined Fibre/Wi-Fi deployment projects 	<ul style="list-style-type: none"> • Network elements expensive • Deployment relatively slow

Table 1: Comparison of Tshwane Free Wi-Fi and Western Cape Broadband Initiative

Source: Author’s notes.

One critique is that the replicability and viability of the project without a state sponsor is questionable. Another critique has been that it did not result from an open tender, as was the case in Cape Town and Ekurhuleni. When service providers are compared on pricing (as was done with the three Western Cape pilot projects), Herotel is a relatively expensive solution and does not provide fibre connectivity, which is usually the core of the tender requirement. A comparative summary is provided in the table.

In the longer term, Project Isizwe, the company operating the Tshwane Free Wi-Fi network, expects that input pricing will reduce to the point where free Wi-Fi is no longer considered a significant expense. Until then the model is entirely dependent on substantial public funding. There is a danger, as happened with the first generation public Wi-Fi in the smaller towns of Knysna, and later in Stellenbosch, of an innovative private company driving the project vigorously and enthusiastically but then departing, leaving the municipality to carry the project, without the internal capacity to do so.

Private sector stimulation in Cape Town and the Western Cape

The project approach in Western Cape is more complex. The province and city take a holistic view towards promoting broadband on multiple fronts. One of the foundations of this model is to stimulate private sector investment in broadband:

by improving information on the market (they undertook an assessment of supply and demand side digital readiness in 2015); by helping investors to understand the costs; by creating demand (with government as an “anchor tenant”); and by reducing capital outlay requirements (by paying for part of the infrastructure). At the provincial level, the Western Cape Government is implementing a fibre/Wi-Fi contract to connect government buildings and selected Wi-Fi sites. The tender that the second fixed network operator, Neotel won created the opportunity to deliver services via both fibre and Wi-Fi, using government as the anchor tenant, but pursuing the private sector market as well.

On the other hand, the City of Cape Town (CoCT) is encouraging private investment by reducing the upfront capital outlay required. They provide the connectivity from a central point to the remote location and also to the access points (APs). The Internet service provider (ISP) only has to offer the data connectivity. This model is more expensive to implement than the Tshwane model, but includes the private sector and fosters innovation and open competition.

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GLOSSARY OF TERMS

Term	Definition or meaning
3G	Third generation mobile cellular
3GPP	Refers to the family of third generation mobile. The purpose of using the term in this report is to distinguish 3GPP, the mobile cellular ecosystem used by incumbent mobile operators (such as MTN, Vodacom) from that of Wi-Fi (which is not a 3GPP technology). 3GPP technologies include GSM, 3G and LTE.
access point or AP	The physical equipment, which is connected to a high site and provides Wi-Fi connectivity to customers. Another common term is a “hotspot”. An area offering Wi-Fi (sometimes called a Wi-Fi zone) may be served by one or more APs. Therefore, there are usually more APs in a network than there are Wi-Fi areas or Wi-Fi zones.
cap	A colloquial term for a data allowance. In this report, the cap is specified in terms of free megabytes allocated per device per day, or (in some cases) per month.
CoCT	City of Cape Town (the metropolitan authority)
hotspot	A service point from which Wi-Fi is offered, usually public Wi-Fi. Since the term can refer to a single access point, or a Wi-Fi zone (consisting of multiple APs) the term is used with caution in this report.
FIZ	A free internet zone. A single area with FPW coverage, in the parlance of Project Isizwe.
FPW	Free public Wi-Fi
ISP	Internet service provider. An ISP typically provides Internet services, but may provide these over the access infrastructure of another operator.
KZN	KwaZulu-Natal
LAN	Local access network. This is a private network, normally consisting of Ethernet cables or Wi-Fi connections, connecting devices (for example) in a home or office.
LTE	Long Term Evolution is the latest 3GPP wireless technology, offering improved performance in a number of respects.

Mbps	Megabits per second – the data throughput rates in millions of bits per second. In this report, most references are to the download rates that a device can achieve, using Wi-Fi.
PC	Personal computer. The PC is referenced to highlight the distinction, albeit a narrowing one, between a PC (with keyboard and mouse entry, and full-feature Windows or similar multi-tasking operating system) and (say) a smartphone or digital tablet.
POC	Proof of Concept. A (small) project implemented to demonstrate that a concept works as envisaged, or to test a concept.
PPP	Public-private partnership. In the context of this report, the common model is for a private company to deploy (and optionally, to manage) infrastructure on behalf of government, on pre-arranged terms. Partnership terms can vary.
SA Connect	South Africa’s broadband policy, known as “South Africa Connect: Creating Opportunities, Ensuring Inclusion” which was adopted in 2013 and includes a section on vision and targets for broadband connectivity.
(Wi-Fi) site	See Wi-Fi zone.
Telco	Telecommunications company/operator
WISP	Wireless ISP. An ISP that operates its own infrastructure, based largely on wireless connections (which usually make use of licence-exempt spectrum).
Wi-Fi®	A term licensed to the Wi-Fi Alliance®, referring to the body of standards for wireless data communication known collectively as the 802.11 family, agreed by the Institute of Electrical and Electronics Engineers (IEEE). What is of interest to this report is that standards are sufficiently advanced to allow generally seamless establishment of connections between devices (such as laptops, tablets and smartphones) and public APs. Of further interest is that the standards are evolving, allowing faster connections and reducing equipment prices. For primarily commercial information on Wi-Fi, visit www.Wi-Fi.org and for technical standards detail, see www.ieee.org .
(Wi-Fi) zone	In this context, a zone (or a site) is an area covered by public Wi-Fi. The distinction is that a zone can consist of one or multiple APs.

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INTRODUCTION

The overpromise and under-delivery of public Wi-Fi in the last decade in the northern hemisphere meant that public Wi-Fi, privately or publicly funded, has been slow to gain traction in Africa. In the United States in particular, cities with public Wi-Fi were meant to provide access for low-income users, connecting citizens to local government and tourists to local information, and even linking the public internet with things like wired parking meters and street lights. But it never really did. The reasons for this have been attributed variously to technical, regulatory and commercial factors most of which are not inherent to Wi-Fi but to the timing and context into which it was introduced³. In cities, where most people had access to high-speed fixed and mobile connections that they could afford to use, the value of low quality or limited bandwidth access was not going to be a major driver of publicly or privately provided Wi-Fi. Where this was not the case, Wi-Fi was likely to be congested and not able to meet the requirements of individuals' private use.

In addition, the advent of Wi-Fi in more mature economies preceded the shift from computer to smartphone as the primary device to connect to the Internet. In mature, yet heavy mobile user markets, such as Hong Kong, cities were able to use public Wi-Fi networks to better inform citizens on public services, and to encourage commercial activity as an extension

of the widespread fibre connectivity in the city. This better reflects the conditions that are reigniting the deployment of Wi-Fi globally, but in Africa particularly as an access strategy. According to a report published in 2015, global Wi-Fi hotspot numbers are expected to grow to more than 340 million by 2018; that is one hotspot per 20 people (iPass 2015)⁴. Of course, these figures do not reveal that the large number of private hotspots contributing to this figure are concentrated in more affluent areas of cities around the world or historically in cities with the political will and resources to connect citizens and tourists on the move to public information, like timetables, traffic congestion, public events, or in support of local commercial activities.

Conditions in Africa are, of course, very different. Firstly, large numbers of people have no or very limited access to broadband and, for those who are able to access it regularly, the use of it is inhibited to various degrees by the relatively high price of data and internet-enabled devices. In some cases, this is a result of the lack of competitiveness in the markets; in others, it is the lack of effective regulation of operators. But, where prices have come down, the real costs of rolling out dollar-based, greenfield networks – often having to develop complementary road and power infrastructure – make even cost-based prices unaffordable for large numbers of people in countries with some of the lowest gross national incomes per

³ See Fraser, E. (2009). 'The Failure of Public WiFi', *Journal of Technology Law & Policy*, 14(2): 161-78.

⁴ iPass inc. (2015). "The global public Wi-Fi network grows to 50 million worldwide Wi-Fi hotspots", Available at: <https://www.ipass.com/press-releases/the-global-public-wi-fi-network-grows-to-50-million-worldwide-wi-fi-hotspots/> [6 July 2016].

capita in the world. Mobile cellular provides only part of the solution because highly priced coverage and slow data speeds (particularly in outlying areas) often exclude the poorest communities. Poorer customers who use mobile Internet usually use it sparingly, due to cost, and are therefore denied many of the benefits of broadband. Wi-Fi offers lower-priced Internet at higher data speeds, and thus has the ability to target marginalised communities.

This is arguably the primary policy challenge for African countries. Universal service strategies that initially focused on the development of fixed networks through dedicated universal service levies proved by and large unsuccessful. Efforts to aggregate demand through the creation of telecentres had mixed results, but generally subsidised supply side driven initiatives had short-lived success or failed. Some centres that were community initiated and generally driven on some form of entrepreneurial or commercially sustainable model worked. But with the advent of mobile broadband and smart devices, the price and skills barriers that computer-based Internet access created were increasingly removed, undermining the logic of access device aggregation.

Increased Internet penetration (with its widening coverage), mobile technology upgrades to 3G (and now LTE), and the affordability of smart devices have combined to increase mobile data uptake. Mobile devices can offer adequate user experiences with web browsing, email access, messaging and an increasing

variety of applications. However, mobile cellular services are only part of the solution, due to high data prices, limited coverage – which often excludes the poorest communities – and slow data speeds (particularly in outlying areas). According to the RIA African Mobile Prepaid (RAMP) pricing indices, data prices remain high across the African continent. Poorer customers who do use mobile Internet usually use it sparingly, due to high costs, and therefore lose out on many of the benefits of broadband access.⁵

Wi-Fi is considered a natural candidate to improve broadband access as it can ameliorate Africa's problems of low broadband penetration and inequitable access. From a public policy perspective, Wi-Fi offers lower-priced Internet at high data speeds, with the added possibility of targeting marginalised communities since it can increase access areas that mobile network operators are reluctant to cover. In the drive to connect the next billion, focus on the limited access as a result of high prices, low skill levels or limited relevant or language-specific content has been lost. Some of the solutions, such as zero-rated services or cheaper service-specific top-ups contribute to reducing costs. But generally these are low-bandwidth apps or services and there is still a challenge for price-sensitive users to download software updates or video content. When accessing content not recognised by the relevant top-up, connection slows considerably. Free capped or low-cost public Wi-Fi services would allow for more people, if not all, to access the Internet.

⁵ Rey-Moreno, C. (2013). "Alternatives for Affordable Communications in rural South Africa". September 2013, Policy Brief. Available at: www.apc.org/en/system/files/Policy%20brief%20Cost%20to%20Communicate_13092016_FOR%20SUBMISSION.pdf

There are various models of FPW in South Africa but in this section we will draw conclusions about the nature of demand and use of those funded by the Western Cape Government and the City of Tshwane metropolitan municipality.

What is Wi-Fi?

Wi-Fi is an inherently disruptive technology that allows a new generation of telecommunications operators to compete with established incumbents in both the fixed and wireless markets. Although many analysts point to the exponential growth of mobile (3GPP) data consumption, Wi-Fi traffic has been shown to exceed mobile traffic in countries where comparative studies have been undertaken, including in South Africa.⁶

It is a family of radio communications standards designed to work predominantly on licence-exempt radio spectrum. This radio spectrum was originally, consciously set aside almost a century ago by the large, government-controlled telecommunications companies of the day, for non-communicating purposes, such as radiation heating (used for example, by microwave ovens, but with other industrial, scientific research and medical applications). In countries the world over, the commercially useful communication spectrum has been tightly controlled, first by the telecommunications companies themselves, and later by national regulators for limited licence allocation. In response, dozens of innovative companies (including large companies, such as Intel Corporation) collaborated to develop a Wi-Fi

ecosystem able to disrupt both the fixed-line market and the wireless broadband ecosystem serving mobile operators. Based on a different business model, Wi-Fi infrastructure is relatively cheap and offers fast data speeds, both compelling attributes for an alternative wireless broadband mechanism. On the one hand, Wi-Fi coverage has not been as extensive as that of traditional mobile cellular; on the other hand, it is generally available in urban, high-density environments, where demand is high. While mobile operators are building out their networks, Wi-Fi is seen as an opportunity for mobile operators to offload some of their traffic to relieve congestion. Some of the large mobile operators, such as Orange, have seen such a good business case in Wi-Fi that they have focused on setting up separate Wi-Fi businesses.

Wi-Fi in South Africa

At the time that Wi-Fi technology took off more than a decade ago, exploiting the licence exempt 2.4GHz frequency band set aside globally for industrial, scientific and medical use and experimentation, the market was really only starting to open up following the end of Telkom's exclusivity, the delays in the licensing of the second network operator, Neotel and the policy confusion over the permissibility of self-provisioning by ISPs. In 2008 ICASA published regulations exempting certain uses of spectrum without a frequency licence, subject to certain technical restrictions, including in the 2.4 ISM band

⁶ Mybroadband. (2015). "Smartphone, tablet data use: Mobile versus Wi-Fi". 5 January (Available at: <http://mybroadband.co.za/news/broadband/115633-smartphone-tablet-data-use-mobile-versus-wi-fi.html>) [5 January, 2015]

used for Wi-Fi and the 5.4GHz Outdoor Hiperlan and 5.8GHz ISM bands, which are used extensively for the provision of Wi-Fi services in rural areas.⁷

As the regulator struggled with the transition to an open environment, a number of public Wi-Fi initiatives, bizarrely including one that was connecting orphanages and schools, were shut down and their equipment seized for not being type-approved and for interfering with licensed operators whose rights supercede those of the unlicensed operator⁸. As a result of these early test cases, the entry into the South African market was largely limited to the commercial application of Wi-Fi, with high-end coffee shops and conference venues making limited bandwidth available in exchange for purchases of their products. As in more mature markets, this was a complementary service, with few people using it as their major or primary source of access.⁹

However, even with the policy and regulatory lethargy that beset the country as it moved into the second decade of the century, with the rise of competing broadband technologies and the finalisation of global standards for the commercialisation of Wi-Fi, the commercial and public access opportunity Wi-Fi

provided could be no longer ignored. The new standards enabled access speeds that technically exceeded 1Gbps. Wi-Fi was becoming ubiquitous in many countries and device manufacturers were responding with tablets and smartphones that defaulted to Wi-Fi when available. Applications had begun to leverage these developments – not just voice, but also M2M, data analytics and Internet of Things.¹⁰

In South Africa these developments were led by early adopters and bandwidth intensive users. But they were being joined increasingly by people gaining access to broadband services for the first time through mobile phones. This pushed up demand for data; despite the high prices. With a lack of suitable spectrum available, due to the failure to assign high-demand 4G spectrum over several years, mobile operators faced demand that exceeded supply in many of the major centres and at particular times of the day. In many instances, these demand patterns aligned with the demands of high-end urban users able to access Wi-Fi spots. Unlike many markets, where Wi-Fi was perceived as disrupting the GSM market, mobile operators saw the extension of Wi-Fi throughout the country as a positive development, allowing them to offload traffic.

⁷ Independent Communications Authority of South Africa (ICASA) published Notice 926 of 2008 on 29 July 2008 in Government Gazette 31290, Licence Exemptions. ICASA may exempt certain uses of spectrum from the licensing requirement, and prescribe the conditions under which unlicensed use must take place. ICASA has recently prescribed certain spectrum licence exemptions, including for the use of the 2.4 GHz band for wide-band wireless systems. It has set out a table of uses of spectrum exempt from the spectrum licensing requirement, indicating the frequency band, type of device, maximum radiated power, relevant standards and any additional requirements.

⁸ Vecchiato, P. (2009). "ICASA defends Wi-Fi confiscation". 20 February. (Available at: http://www.itweb.co.za/index.php?option=com_content&view=article&id=20376)

⁹ The Wi-Fi Forum reported to ICASA that research was undertaken by iPass, which indicated that in 2014, there were 8 611 commercial hotspots in South Africa. This equates to one hotspot for every 6,155 people in the country. These hotspots are mainly located at retail outlets (3 211), hotels (3 099), and cafes (2 256). (See "South Africa's Wi-Fi versus the world", My broadband. 3 Dec 2014. (Available at: <http://mybroadband.co.za/news/wireless/113349-south-africas-wi-fi-versus-the-world.html>)

¹⁰ Wi-Forum 2018 presentation to ICASA as part of public hearings. (See footnote 5).

Cellular networks are facing severe traffic surges, due to the proliferation of smart handheld devices and data-hungry applications. A cost-effective and practical solution is to offload cellular data through Wi-Fi. Recent theoretical and experimental studies show that a scheme, referred to as “delayed Wi-Fi offloading”, can significantly save cellular capacity by delaying users’ data and exploiting mobility, thus increasing the chance of meeting Wi-Fi APs.

Despite the huge potential of Wi-Fi offloading in alleviating the mobile data explosion, its success largely depends on the economic incentives provided to users and network providers to deploy and use delayed offloading. There has been little attempt to quantify independently the economic benefits resulting from delayed Wi-Fi offloading – these have been largely assumed.¹¹

Increased smartphone penetration

One reason for this growing optimism over Wi-Fi is the increasing affordability and penetration of connected mobile devices (smartphones, phablets and tablets). The reduction in cost of entry smart devices has driven up the rate of broadband use,

including in emerging markets and in lower income market segments. According to South African Audience Research Foundation (SAARF)’s AMPS survey (for the period ending June 2015), over 50% of South African adults aged 15 and older have used a smartphone. Using the Living Standards Measure (LSM), the data shows a particularly dramatic increase in smartphone penetration amongst the lowest income brackets (LSM 1–4), from 14% in June 2014, to over 22% a year later.¹³

Smartphones offer an acceptable user experience of the Internet (from browsing to emailing, to watching videos). The AMPS survey found that 36% of South Africans access social networks (predominantly Facebook and Twitter) with 96% of them accessing those two services from their smartphones.¹⁴ When one considers that less than half the population have access to the Internet, and that most new users access it for the first time from mobile phones, the significance of social networks in driving uptake is clear.¹⁵ Compared with the high smartphone use, only 23.5% were found to have Internet access at home via a computer (laptop or PC). Tablet use had grown from 5.5% to 7.0% in six months.¹⁶

¹¹ By modeling the interactions between a single provider and users, based on a two-stage sequential game, Joohyun Lee, Yung Yi, Song Chong and Youngmi Jin analytically prove that Wi-Fi offloading is economically beneficial for both the provider and users. Also, they conduct trace-driven numerical analysis to quantify the practical gain, where the increase ranges from 21% to 152% in the provider’s revenue, and from 73% to 319% in the users’ surplus. “Economics of Wi-Fi offloading: Trading delay for cellular capacity”. 31 December 2012. (Available at: <https://arxiv.org/pdf/1207.6607.pdf>)

¹² SAARF. (2015). “AMPS 2015A” (survey results ending June 2015). Published October. Slide 65.

¹³ *Ibid.* Slides 67,68

¹⁴ *Ibid.* Slides 69,70

¹⁵ Stork, C., Calandro, E. and Gillwald, A. (2013). Understanding internet going mobile. Internet access and use in 11 African Countries, Policy Paper 14, Research ICT Africa, Cape Town. www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_14_-_Understanding_Internet_Going_Mobile.pdf

¹⁶ *Ibid.* Slide 84

Low-end smartphones entering the market, with ever-increasing screen size and quality, memory storage capacity and processing power, enable a rich experience with the most popular social networking and messaging services (for example, Facebook, Facebook Messenger, WhatsApp, WeChat, Instagram, Twitter and Snapchat). Productivity applications, such as Microsoft Office Suite, are available on smartphones, as well as a number of other cloud services, such as video streaming and file storage. These are often available at zero purchase cost (including the smartphone versions of Microsoft Office applications). Importantly, mid-range smartphones offer a compelling experience when capturing, editing and viewing videos. Therefore, smartphones afford an adequate, stand-alone Internet access experience, while phablets (cellphones with larger screens) and tablets (with larger screens and built-in connectivity) continue to drop in price.¹⁷

Device suppliers, pioneered in particular by Apple Inc¹⁸, have realised that the key to mass uptake of their devices is ease of use, including simplicity in setting up, connecting, using and installing apps. Therefore, the technical barrier to use of these devices and installation of software is relatively low, compared to (say) PCs.

To summarise – connected, mobile devices have become more plentiful, more powerful and easier to use, and with a variety of free applications and

services available. The self-reinforcing ecosystem has successfully reached lower income groups.

Affordable access to broadband connectivity remains a significant constraint, however, with cellular data pricing seen as inhibitive. This has prompted policymakers to consider the role that Wi-Fi could play in overcoming this constraint, in particular by assessing the potential to make free or affordable Wi-Fi coverage available to those for whom broadband is otherwise unaffordable, thereby promoting inclusive broadband access.

Wi-Fi revenue models

Wi-Fi as a disruptive technology allows new competitors to enter the wireless data market and to introduce new business models. These emerging business models commonly include an element of free access. For data to be provided free to the consumer, it must be sponsored by a third party. The most common sponsorship models are listed in Table 2 on the next page.

For the purpose of this report, the concept of Free Public Wi-Fi (FPW) refers to a government-sponsored, publicly accessible Wi-Fi broadband service.

The specific objectives a government authority may wish to achieve (typically expressed as socio-economic benefits) are introduced in the next section and are interrogated further in each subsequent section of this report.

¹⁷ In late 2015, the price of a 3.5" Vodacom Smart Kicka was \$35 (ZAR500), while a Lenovo was priced at \$150 (R2200).

¹⁸ Bjarin, T. (2012). "6 reasons Apple is so successful", Time (magazine). May 7. (Available at: <http://techland.time.com/2012/05/07/six-reasons-why-apple-is-successful/>)

Sponsor	Value obtained
Operator	Gives away an initial free bundle (per venue) to entice the customer to buy additional access when the free bundle runs out. This business model depends on a certain conversion ratio being achieved.
Venue owner	The owner of a small venue, such as a café or restaurant sponsors Wi-Fi to attract or retain clientele. The Wi-Fi is seen as part of the value offered to the customer (for example, in a hotel or at a conference centre). The venue may be large (a shopping mall, public beach or tourist precinct), and be co-sponsored by a group of commercial interests.
Advertiser	The advertiser pays the operator to interact with customers, as a targeted audience who do not pay for access.
Analytics user	A company pays for legitimate access to customer information, derived from sponsored Wi-Fi access systems. These systems can build sophisticated customer information and aggregate trends, based on variables, such as customer Internet use behaviour and use location information.
Government	Local, provincial or national government can sponsor Wi-Fi to promote socio-political or economic objectives at the level of a venue, city, province or country.

Table 2: Common Wi-Fi sponsorship models

Source: Author's notes.

Emergence of free public Wi-Fi internationally

FPW has long been considered and deployed across the world for a range of economic and governance reasons. A study in 2008¹⁹, for example, refers to projects by community groups and municipalities, going back to at least 2000, with early implementation in Canada, the United States (US), the United Kingdom (UK), Taiwan and Estonia. The study mentions 65 international projects by 2005, and over 200 city projects in the US by 2007, with a further 215 planned. A selection of projects at the municipal level listed on Wikipedia²⁰ show widespread deployment

across Europe and Asia, well-known examples being in Hong Kong and Seoul.

Reasons given for providing free service include general economic development²¹, investment in city centres (to attract visitors and good employees, and therefore businesses)²² and support for tourism. Between 2013 and 2015, the UK Government connected 1 000 public buildings across the country, which, according to their Digital Economy Minister, Vaizey²³ is part of their "SuperConnected Cities" programme. The programme is part of a broader, long-term economic plan to transform the digital capability of UK cities,

¹⁹ Middleton, C. and Crow, C. (2008). Building Wi-Fi networks for communities: Three Canadian cases, *Canadian Journal of Communication*, 33: 419-441.

²⁰ Wikipedia. (Available at: https://en.wikipedia.org/wiki/Municipal_wireless_network) [4 December, 2015]

²¹ See web reference: <http://archive.northjersey.com/news/englewood-business-organization-moving-forward-with-wi-fi-plan-1.607879>

²² Napier, J. (2013). "State's fastest public Wi-Fi now live in Amherst, Mass". Jan 10. (Available at: <http://www.govtech.com/wireless/States-Fastest-Public-Wi-Fi-Now-Live-in-Amherst-Mass.html>) [4 December, 2015]

ensuring the cities can “boast world-class connectivity and are equipped to deal with the increasing demands of the digital age” and become “more attractive places to live, do business, visit and invest in”.

Goldstuck²⁴, reporting on a trip to Israel, cites numerous free Wi-Fi services that are easy to use and offer reasonable download speeds, including access on inter-city buses. He says that Tel Aviv began deployment of 80 hotspots from 2013, to demonstrate the intention to become a leader in innovation. The head of Google Israel sees the extensive coverage across Israeli cities as an extension of Israel’s success as a “start-up” nation, embracing the power of the Internet to facilitate collaboration.

A recent Australian study²⁵ observes that Australia provides free public Wi-Fi in a number of museums, libraries, tourist centres and public transport areas. According to this report, Wi-Fi was introduced into museums, galleries and state libraries relatively early on, in order to provide information about exhibitions.

As far back as 1994, the US had 21% of public libraries connected to offer free PC-based access and had almost 100% connected by 2004. By 2014, close to 100% also offered free Wi-Fi access. Digital inclusiveness is a specific objective. Libraries offer both PC access and Wi-Fi, so that productivity tools

that are more suited to workstations can be accessed. Librarians are equipped to assist users with their searches, including searches on employment databases and applications for unemployment benefits.²⁶

In Brazil, Telebras, the incumbent operator, was the primary partner in the government’s major initiative to increase broadband penetration, including provision of FPW in public city parks. Municipalities invested in further FPW ahead of the 2014 Soccer World Cup.

FPW initiatives, therefore, have an established international history and are now relatively widespread, with the original business models for these based on the support of a range of economic objectives. Africa has lagged behind many other parts of the world in providing FPW, although initiatives now exist in a number of the capital or main cities – notably Nairobi, Kigali and Lagos.

Municipal initiatives in South Africa enjoyed an early start with a forward-thinking project commencing in Knysna ten years ago and a well-publicised project in Stellenbosch. Although these early projects failed to gain traction, a spate of subsequent projects in South Africa’s main cities and surrounding areas has taken the concept forward.

The projects within South Africa are described in a subsequent section, “Free public Wi-Fi initiatives in South Africa”.

²³ UK Government. (2014). “1 000 buildings in UK cities to get free public Wi-Fi”. 30 October. (Available at: <https://www.gov.uk/government/news/1000-buildings-in-uk-cities-to-get-free-public-wi-fi>) [19 December 2015]

²⁴ Goldstuck, A. (2014). “Israel’s lesson in free Wi-Fi”. Mail and Guardian. [29 May, 2014]

²⁵ Lambert, A. *et al.* (2013). “Free Wi-Fi and public space: The state of Australian public initiatives”. University of Melbourne/Institute for a Broadband-Enabled Society.

²⁶ Bertot, I. *et al.* (2015). “2014 Digital Inclusion Survey: Survey findings and results”. Information Policy and Access Centre of University of Maryland.

PROBLEM STATEMENT

Governments can maximise the unique opportunity that Wi-Fi now presents, to increase broadband penetration, while also promoting digital inclusivity. They can consider how best to promote Wi-Fi within the context of their overall strategy. However, as with most infrastructure-dependent approaches, there are multiple combinations of different investment and policy options to consider. For governments, such decisions are difficult to make when projects are in new territory and there is little internal experience to draw on.

South Africa, although facing numerous challenges regarding broadband provisioning, is fortunate to be able to review a diverse range of Wi-Fi projects aimed at solving these challenges. This diversity provides a rich research opportunity for comparing models and contexts, in order to assess effectiveness (or potential effectiveness), particularly of government-sponsored FPW.

Wi-Fi projects tend to be sponsored from provincial or municipal budgets, and so compete with fiscal demands for basic amenities for the poorest communities, such as water, sanitation, housing and electrification. Projects must be properly motivated. This raises fundamental questions: Should government be funding such projects at all? Should government be implementing projects? What

relationships should exist with the private sector?

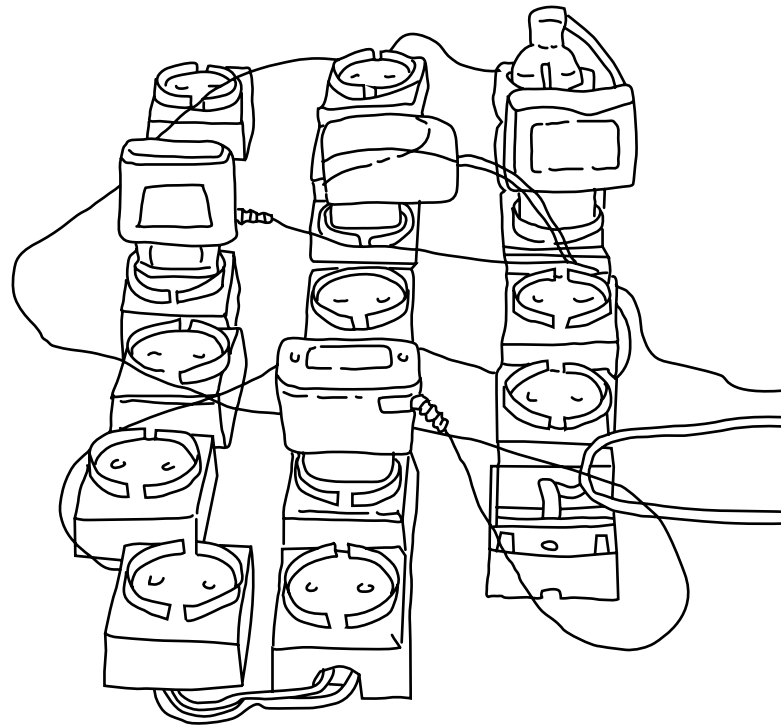
Initiatives in South Africa share objectives with those in other countries, although with more focus on the development objectives of increasing overall broadband penetration, providing Internet access as a basic human right and addressing digital inclusivity. With commitments from government to ongoing investments in such initiatives, it is important to understand which models show the most promise for replication, and to learn how to improve projects in future. The models involve very different (often competing) points of departure and, therefore, fundamental project design and implementation choices must be made upfront, which will have effects for years to come. If wrong or uninformed implementation models are embraced, they can lead to expensive failures. Similarly, if learnings from projects are not shared with others, costly mistakes are often duplicated. Therefore, informed options about designing and implementing Wi-Fi are very important.

In order to inform these choices, one needs to know what initiatives are underway, what the objectives of the initiatives were, what approaches they are taking, and the reasons behind these approaches. It would be useful to understand the costs involved and whether any usable results have emerged from the projects thus far, particularly

in terms of the original objectives set for the projects. This information can highlight similar and contrasting approaches, and identify learnings that are emerging.

It is also important to step back and ask whether, conceptually at least, there are deeper questions to ask, for example, are there other approaches to explore, based on international learnings or parallels in provisioning of other basic services? Another fundamental question relates to the potential sustainability of projects. Technology-related questions may arise, such as whether the access technology selected either promotes or impedes competition.

Wi-Fi holds enormous promise to contribute to the vision of rapid promotion of broadband in an inclusive manner, provided that projects learn from what has been done thus far, and are well-informed, well-conceived and well-designed to make judicious use of scarce resources.



METHODOLOGY

A departure point for this report is the South African Government's broadband policy, SA Connect²⁷, which restates many socio-economic benefits as the rationale for the policy itself and also includes a Vision for 2020 and connectivity targets for 2016, 2020 and 2030.

The report builds on the assumption that free (or affordable) public Wi-Fi is a compelling option to drive broadband penetration, based on the argument already outlined in the Introduction, and also notes the popularity of such initiatives in South Africa right now.

A brief international scan (see Emergence of free public Wi-Fi internationally), raises questions, makes a comparison or highlights an issue pertinent to South Africa but it is not comprehensive and must be kept in mind that there are aspects of South Africa's initiatives that are unique. In the review, digital inclusiveness issues were examined. While developed countries have more resources at their disposal, and tend to implement public Wi-Fi to compete with other regions for tourists or businesses, countries with developmental broadband projects have tended to focus on strategies that are not Wi-Fi centred, such as promoting fixed connectivity (Brazil, Mauritius), reducing mobile data costs (Kenya) or promoting wholesale broadband connectivity and extending mobile coverage of 3G and LTE (Botswana).

The main body of this report is based on desktop research (mainly of publicly available resources) to identify key current and historical projects across South Africa. The report considers objectives that the organisations under review provide as their stated rationale for their Wi-Fi projects. This approach enables comparisons to be made and builds a picture of the common reasons for undertaking projects.

Individuals within the most significant projects were interviewed for further information and clarification and were requested to make available non-confidential information. The cities of Cape Town and Ekurhuleni provided information, as did the Western Cape Provincial Authority and Project Isizwe on behalf of Tshwane Free Wi-fi. In a number of cases, important information is confidential or results are not yet collated.

Qualitative research was based on interviews with users of the Tshwane Free Wi-Fi as well as Neotel networks, the latter being the delivery partner of the Western Cape Broadband Initiative and operating a number of hotspots. Both Neotel and the Tshwane Free Wi-Fi delivery partner, Project Isizwe, conducted online surveys with users.

The report uses research results to the extent they are provided by the projects under review. However, the scope of the report does not extend to

²⁷ Republic of South Africa. (2013). "South Africa Connect: Creating Opportunities, Ensuring Inclusion". *South Africa's Broadband Policy*. 20 November, 2013 (Promulgated as Department of Communications Notice 953, on 6 December, 2013).

independent user surveys or actually measuring the socio-economic impact of these projects. While this is an important undertaking, it is resource intensive and requires a rigorous baseline survey which could be followed by an 'end-line' study.

Smart City initiatives and related fibre-optic projects by cities were explored briefly, as these initiatives appear to have determined the character of ensuing Wi-Fi projects. The Herotel Telecoms/Project Isizwe co-entity was also explored as an outspoken champion seeking public Wi-Fi sponsorships in both larger and smaller projects.

For each project, initial observations are made, based on the merits of the project itself, combined with evaluations (when made public) by members within the projects. Therefore, the first level of the report is a project review. The report then draws conclusions on the overall project landscape in the country, as the grouping of these projects is a finding in itself.

The second level of the report compares each project against a set of criteria based on a basic taxonomy of sponsorship models. Although both municipal and commercial Wi-Fi can be free to the customer, there is always a funder (sponsor of the service) and a return of some description (financial, social) is always sought. The combinations of who the funders are and what they are seeking leads to a variety of different business models. (The more common sponsorship models were described

in Table 2 above.) Finally, the study uses this understanding about funding (as well as capability to deploy projects) to test the underlying premise of government involvement in free Wi-Fi to suggest which models are most likely to be sustainable, and to suggest what should be done to enhance sustainability.



FREE PUBLIC WI-FI INITIATIVES IN SOUTH AFRICA

This section provides a narrative on each significant project, followed by a direct evaluation of that project, as described in the previous methodology section.

The first two projects examined below were selected as forerunners of the other initiatives and are described largely for historical completeness. Having not gained traction, largely as a result of being ahead of their time (Knysna in particular), they are now less active than at their peak. While they could have been described under Western Cape initiatives, they are not coupled to current initiatives within that province.

The town of Knysna

The first FPW project to be publicised was undertaken by the Knysna Municipality in 2006 – Project “UniFi Knysna”. In 2005 the local authorities selected (then) service provider Uninet in a tender process to offer “converged services” (Internet access and voice-over-IP) via an open access network in the small town. Uninet could connect government buildings to the datacentre as well as provide free Wi-Fi to nearby communities who could not afford access. This description of the project is taken largely from Uninet’s own case study²⁸, where it claims to have actually initiated the project, commencing engagement from as far back

as 1999. The rationale for funding the project (in other words, the five-year, renewable tender) was to take the municipality’s existing communication budget as upfront payment for the upgrade of the network in such a way as to realise budget savings over the five-year period.

The success factors Uninet gives for the project are numerous. Uninet indicates that the underlying driver of sustainability is ongoing funding, which the local authority, in turn, needs to derive from the increased business activity (and hence increased local rates and taxes) that the Wi-Fi service catalyses. Benefits of productivity, attracting business, reduced crime, increased service delivery, improved health and education and similar effects are listed. In truth, the project combined a full municipal and open-access network deployment with Wi-Fi components and, therefore, the benefits specific to Wi-Fi were not identified. In 2006, Wi-Fi-enabled devices were not yet widely accessible to low-income households.

Uninet persevered, in spite of two significant setbacks. The first was active interference in the project by Telkom (the incumbent operator, which enjoyed exclusivity in providing certain services until 2005) who claimed the project was illegal. The second was that the funding mechanism and partnership were innovative and, therefore, seen as risky to both the local authority and the National Treasury.

²⁸ Uninet. (Undated). “Knysna open access network case study”. (estimated 2006 or 2007).

Uninet was able to overcome these hurdles, deploy the hotspots and publicised the project as a success, with great promise to grow²⁹. The project was given a special mention by the International Telecommunication Union (ITU) in the practice notes of ICT Regulation³⁰. In that study, it was described as having 200 AP's (offering unlimited access per subscriber, but with a 45-minute daily limit being planned), and 13 VoIP phone booths (which can make free phone calls to each other).

Uninet has since restructured and changed focus. The local authority indicates that it has taken over and continues to operate these hotspots, but could not say how many were functional. Knysna put a tender out for the provision of fibre, which the manager for economic development believes will “up our game tremendously in this field”.³¹ A resident³² and a local councillor³³ were not aware of the ongoing function of the hotspots and there was no recent online information indicating current status.

Knysna as a subject for further study

The Knysna project was a landmark first for the country, but was not selected for further study as it commenced and lost impetus a few years ago. One of the problems with the project appears to have

been the strong drive from Uninet (as the supplier), rather than from the municipality itself. Perhaps the town was too dependent on this outside drive. Knysna was, however, possibly ahead of its time (deploying before the recent boom in smartphone penetration). The main legacy of this project was to raise awareness amongst public officials, the media and the public of South Africa. There may well be renewed interest following fibre deployment.

The town of Stellenbosch

The second municipality to enjoy publicity for its FPW service was Stellenbosch. Allan Knott-Craig Junior was CEO of the messaging service, MXiT and was then living in the town. MXiT had a surplus of Internet bandwidth at the time, and Knott-Craig approached the municipality with the proposition that his company could provide free Wi-Fi to the town centre, if they would pay the costs of the APs. Knott-Craig and the project enjoyed significant media attention, especially since customers initially enjoyed faster download speeds than they experienced at home or work.

This project did provide FPW to the town centre (which has a common, high street, shops, restaurants and historic monuments). Shortly after Knott-Craig parted company with MXiT and questions were asked

²⁹ Uninet. (Undated). “Knysna open access network case study”. (estimated 2006 or 2007).

³⁰ See web reference at: <http://www.ictregulationtoolkit.org/en/toolkit/notes/PracticeNote/3175>

³¹ Van Schalkwyk, I. (2016). (Manager for Economic Development, Knysna). Email of 11 January, 2016.

³² Polled in November 2015, person who requested anonymity.

³³ Phone call to Mr Myers, 15 January 2016.

³⁴ Muller, R. (2012). “Free Wi-Fi debacle in Stellenbosch”. 19 November 2012. (Available at: <http://mybroadband.co.za/news/wireless/65032-free-wi-fi-debacle-in-stellenbosch.html>) [6 November, 2015]

in the press about the progress of the project.³⁴ The project appeared to regain momentum, with the mayor confirming his intention that Stellenbosch become a Wi-Fi town and announcing a second phase.³⁵ With the assistance of volunteers, Phase 2 extended the project into three poor communities on the outskirts of Stellenbosch, and the University of Stellenbosch. It now appears to have lost momentum but should still be watched.³⁶ Knott-Craig has been blamed for contributing to its loss of direction, and in return blames Stellenbosch for having “lost its jockey”³⁷ by not appointing a champion within Council to drive this project as it should be driven.

Stellenbosch as a subject for further study

The Stellenbosch project received criticism at inception for being overly hasty, ad hoc and poorly conceived. It was largely supply-driven, with little stakeholder engagement or analysis. The Wireless Access Providers Association (WAPA) attempted to engage with Knott-Craig to point out that FPW was a threat to the small businesses already providing Wi-Fi services in Stellenbosch, who contributed to the economy by employing staff, imparting technical skills, paying rates and providing a quality-controlled service. Geerdts, who was chairperson of WAPA until 2013, emphasised that WAPA is pro-disruption in the market since WAPA itself was formed and grew on the back of the positive

disruptive impact its members had on the market.

“What was problematic was for the municipality to compete for a short while with its own ratepayers, putting small entrepreneurs out of business by offering a subsidised service, only to fold later and leave a connectivity vacuum. The project actually did lose momentum as feared, fortunately before it was able to disrupt the local market [...]”

Stellenbosch highlights the high risk of FPW failing if it is deployed without the proper planning and integration of the FPW project into a wider programme.³⁸

Generic city/province broadband stimulation models

A number of more recent initiatives warrant further examination and these will be discussed in turn. However, first we will describe common threads found in a number of projects to avoid repetition within the descriptions. The projects are also better understood within the broadband-stimulation models from which they emerge, and therefore a shared context can be described.

The common context begins with authorities realising the need to promote broadband and develop local Internet-stimulating strategies, which broadly follow these steps:

- A city-wide strategy (often called a “Smart City Strategy”) or even a province-wide strategy is

³⁵ Mybroadband. (2013). “Free Stellenbosch Wifi Second Phase Now Live”. 4 February 2013. (Available at: <http://mybroadband.co.za/news/wireless/69452-free-stellenbosch-wifi-second-phase-now-live.html>) [6 November, 2015].

³⁶ Alfreds, D. (2015). “Stellenbosch free Wi-Fi limps while SA takes off”. 1 June 2015. (Available at: <http://www.fin24.com/Tech/News/Stellenbosch-free-Wi-Fi-limps-while-SA-takes-off-20150601>) [6 November, 2015]

³⁷ CNBC Interview with Alan Knott-Craig junior. 3 June 2014. (Available at: <http://www.cnbcfric.com/video/?bctid=3602922504001#>)

³⁸ Geerdts, C. (2016). Interview, chairperson of WAPA.

envisioned to stimulate Internet-driven growth. Early initiatives hark back to the late 1990s.

- Within these frameworks, authorities calculate current ICT costs (the costs to connect government facilities) and determine that they can effect savings by consolidating demand and leveraging their purchasing power.
- Governments then procure fibre-based networks to connect their main buildings. Projects are funded from the proven savings on previous expenditure, with government as the “anchor tenant”.
- Projects are rolled out together with complementary activities to stimulate broadband uptake. Typical projects include placing government information online, providing applications in health and education sectors, as well as training programmes.

The above sequence is recognised in SA Connect³⁹ – its section on Digital Readiness refers to pooling demand in the public sector, creating fibre networks that are high-capacity and futureproof and taking up of services in the public sector (including in schools and clinics).

SA Connect also refers to the need for national engagement with municipal and provincial projects to ensure alignment with the policy. The fibre rollout and “government-online” initiatives mentioned below are the results of planning that commenced ten to twenty years ago. At the time, they occurred largely in isolation of each other.

Although this is pre-empting the findings, it is worth remarking that the level of success of provincial and municipal fibre rollouts in project terms (to what extent projects were delivered in time and on budget) and in programme terms (to what extent they integrated planning and achieved programme objectives) can be regarded as a rough indicator of the likely success of Wi-Fi deployments on top of the fibre projects.

Further context comes from the realisation that the public buildings connected by fibre also provide a secure location and power supply for the Wi-Fi APs and that these buildings are often well situated and widespread (schools being a good example). Connected buildings, therefore, tend to include schools, clinics, libraries, recreation centres and parks. Selection criteria include areas where poverty and lack of infrastructure impede Internet penetration.

GAUTENG PROVINCE

Gauteng is the province with the highest population (24% of the total population of South Africa), and within which around a third of the country’s economic activity takes place. The province is highly urbanised, with the majority of the population and economic activity located within three large, adjacent metropolitan municipalities: Johannesburg, Tshwane and Ekurhuleni. Johannesburg is the economic hub of the country, Tshwane is the country’s administrative capital and is also the largest municipality in Africa and third largest in the world. Ekurhuleni is both

³⁹ Republic of South Africa. (2013). “South Africa Connect: Creating Opportunities, Ensuring Inclusion”. *South Africa’s Broadband Policy*. Government Gazette Government Notice Number 953. 6 December 2013. Issued by the Department of Communications in Terms of the Electronic Communications Act, 2005.

populous and home to several industrial centres, as well as the Oliver R. Tambo International Airport.

Each of these three cities has public Wi-Fi plans (which are detailed in this report). However, of note is that no specific FPW details or commitments have been announced by the Gauteng provincial authorities (on the back of its own school connectivity and fibre deployment projects).

Gauteng has, however, announced (and commenced implementation of) plans to introduce an e-learning solution which involved tablets in every school in the province, with an associated connectivity plan based on Wi-Fi and 3G⁴⁰. The details of the connectivity solution are not provided, except that the total solution includes providing 2 200 schools with 44 tablets per school, and with “network lease costs” of R107.2m for two years. The connectivity cost derived from these numbers is R92 per tablet, per month. Gauteng regards connectivity to its educational portal as integral to the project. The previous Gauteng school connectivity project and portal was controversial, costing at least R2.2bn in total (R1m per school) and regarded by many as dysfunctional. There is also concern at the levels of tablet theft and damage.

Aside from the education project, no Wi-Fi plans (or fibre plans) were evident for the two districts outside of the three cities – Sedibeng and West Rand.

Each of the three cities, and the province itself, has its

own ICT promotion strategy: each including an element of fibre deployment (commencing with connection of public buildings) and a number of sectoral e-initiatives. The individual plans of the cities (but not the province) also include FPW. The cities and province deploy and manage their ICT programmes largely independently of each other, although they do compare notes and avoid duplicating connections to the same public buildings. However, an important level of coordination to optimise resources is absent.

The provincial plan for broadband (rather than Wi-Fi *per se*), its “smart province” strategy⁴¹, centres around the development of a R1.2bn fibre network (dubbed the “GBN” or the “Gauteng Broadband Network”) which aims to bring connectivity “coverage” to 95% of the province’s population. This five-year project was originally conceived in 2005, but announced in mid-2014, with Alcom Matomo (an Altech subsidiary) having won the tender as the major supplier in terms of building, operating and maintaining. The project is designed to be self-funding in three years (meaning that it will save more on the ICT bills of the government buildings than it costs, resulting in a net capital outlay for the network of only R510m). The network is intended to connect 316 provincial government buildings, 45 Thusong centres (multi-purpose Internet access centres), 20 “townships”, 9 economic areas and 6 urban renewal nodes⁴². Coverage includes the two large provincial hospitals.

⁴⁰ Vermeulen, J. (2013). “Free tablets for Gauteng schools cost breakdown”. August 23 2013. (Available at: <http://mybroadband.co.za/news/government/85075-free-tablets-for-gauteng-schools-cost-breakdown.html>). [13 December, 2015]

⁴¹ Odendaal, N. (2014). “R1.2bn broadband project core to Gauteng’s ‘smart province’ ambitions”. June 2014. (Available at: <http://www.engineeringnews.co.za/article/r12bn-broadband-project-core-to-gautengs-smart-province-ambitions-2014-06-06>). [4 December, 2015]

⁴² *Ibid.*

The Gauteng strategy includes e-government, e-health (including telemedicine) and the flagship provincial educational project based on connected tablets, mentioned earlier.

The Gauteng plan talks in broad terms about linking the three main city initiatives (each of which will be discussed immediately below) as well as connecting to the district authorities, which are less advanced in their planning: Sedibeng and West Rand. Wi-Fi initiatives in these populous but under-served areas are conspicuously absent in this relatively wealthy and urbanised province.

Tshwane (Tshwane Free Wi-Fi, Project Isizwe and Herotel Telecoms)

The *Tshwane Free Wi-Fi* initiative is inextricably linked to the creation and growth of Project Isizwe, and its commercial implementing partner, Herotel Telecoms.

It was mentioned earlier in the report that Alan Knott-Craig had initiated a free Wi-Fi project in Stellenbosch while he was CEO of MXiT. Soon after his sudden departure from MXiT in October 2012, the self-described “serial entrepreneur” turned his hand to providing FPW elsewhere. He approached the major metropolitan authorities. Both Cape Town and Tshwane were eager to pilot Wi-Fi.

Tshwane had a history of broadband innovation, the municipality having offered fibre-based Internet services before other municipalities, as far back as 2006, commencing with the suburb of Hatfield. Tshwane had already (commencing 2011) connected about 100 sites in the two years before Isizwe’s involvement – those being the government offices, libraries and customer care centres as part of its Vision 2055 programme.⁴³

Tshwane was prepared to proceed with a two-phase project without a tender process, to be called “Tshwane Free Wi-Fi”. Knott-Craig soon determined that a non-profit organisation (NPO) was the best vehicle for engaging local authorities about using their funds and infrastructure to provide Wi-Fi and commence with Phase 1 of the Tshwane rollout in November 2013. Herotel Telecoms was the commercial implementing partner.

Project Isizwe⁴⁴ took considerable risk in that payments were made on delivery of results (not upfront). The risk related to the bridging of funding requirements as well as trusting in the local authority’s payment process⁴⁵. The founders went so far as to take out personal surety to finance Phase 1⁴⁶.

The scope of Phase 1⁴⁷ was to connect three educational institutions, a section of a community

⁴³ Alfreds, D. (2013). “Tshwane to roll out free Wi-Fi”. News 24. 15 August. (Available at: <http://www.news24.com/Technology/News/Tshwane-to-roll-out-free-Wi-Fi-20130815>). [6 November, 2015]

⁴⁴ Project Isizwe should not be confused with the commercial enterprise, Sizwe IT Group.

⁴⁵ Knott-Craig Jr, A. and Silber, G. (2015). “The story of Tshwane Free WiFi”. September. (Available at: <http://www.projectisizwe.org/wp-content/uploads/2016/06/1-The-Story-of-Tshwane-Free-WiFi1.pdf>)

⁴⁶ Interview with Project Isizwe’s CEO (Khan) and CTO (Devine), Pretoria, 28 January, 2016.

⁴⁷ Vermeulen, J. (2013). “Free WiFi for Pretoria details”. August 22. (Available at: <http://mybroadband.co.za/news/wireless/84989-free-wifi-for-pretoria-details.html>). [November 5, 2015]

centre (Mamelodi) and two open areas in the CBD town centre. The total area covered was variously given as 40 000m² up to 108 000m². According to the Project Isizwe website⁴⁸, the approximate coverage for each of the above venues was 18 000m² and design capacity for each zone was 5 000 units (totalling 90 000m² and 25 000 users). Isizwe charged R1m for installation, bandwidth and management over a three-year period. Founding member of Project Isizwe, Khan, says that Isizwe budgeted for and charged Tshwane R200 000 per site but it actually cost Isizwe R250 000 and Isizwe had to absorb the loss. Site requirements were very different, with TUT Campus in Soshanguve requiring 12 APs in a long but narrow section, so requiring lateral antenna coverage; Church Square requiring four large (non-standard)

APs; Tshwane North with 10 (lateral sites) and University of Pretoria Hatfield Campus requiring nine APs (including omnidirectional antennas).⁴⁹

Project Isizwe had posted pricing information at that same time (2013) in order to attract either business or government sponsorships. The pricing information (which specifies a minimum rollout of 100 000m²) was as per Table 3.⁵⁰

Given that the Tshwane project was for five smaller zones, and the time frame for the sponsorship pricing in this table is not given, it is difficult to compare what Tshwane was charged with the sponsorship costings in the above table. In any event, this pricing was removed from the Project Isizwe website in January 2014 and was most likely simply early experimentation with the numbers.

Coverage / Population	5 000	10 000	50 000
100 000m ²	USD 15 000 ZAR 150 000	USD 30 000 ZAR 300 000	USD 150 000 ZAR 1 500 000
200 000m ²	USD 30 000 ZAR 300 000	USD 60 000 ZAR 600 000	USD 300 000 ZAR 3 000 000
1 000 000m ²	USD 150 000 ZAR 1 500 000	USD 300 000 ZAR 3 000 000	USD 1 500 000 ZAR 15 000 000

Table 3: Project Isizwe free Internet zone pricing model

Source: Project Isizwe, 2013.

⁴⁸ For further details, see: <http://projectisizwe.org/tshwane-free-wi-fi-phase-1-locations/> (26 Nov, 2013) [6 Nov, 2015]

⁴⁹ Interview with Project Isizwe's CEO (Khan) and CTO (Devine), Pretoria, 28 January, 2016.

⁵⁰ For further details, see: <http://web.archive.org/web/20131111122631/http://projectisizwe.org/fiz-pricing> (Project Isizwe archived material as it was on 11 November 2013.)

Tshwane Free Wi-Fi was to offer 250MB per user per day, 1Mbps download speeds and 256kbps upload. Neotel offered up to 1Gbps bandwidth to Herotel at no cost⁵¹, which saved on project costs and meant that Isizwe could provide the service at a higher data rate than required.

User uptake of the new service was solid, Figure 1, shows the increase in daily unique users, almost doubling over each fortnightly period in which it was measured, to mid-February 2014.

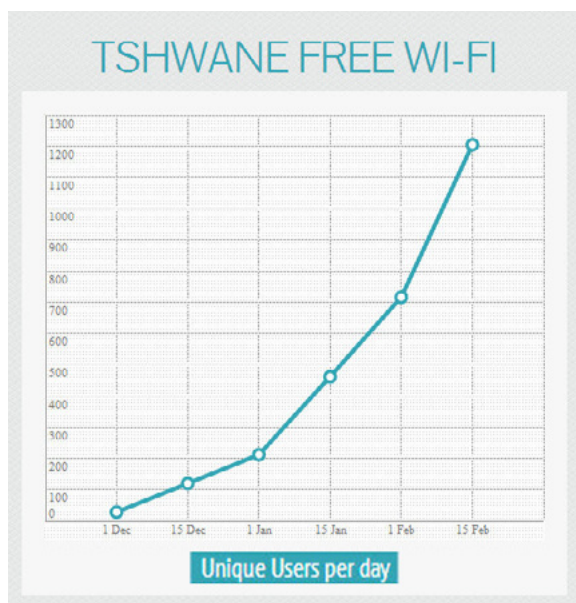


Figure 1: User uptake of Tshwane Free Wi-Fi Phase 1

Source: Project Isizwe, 2014.⁵²

In addition to unique user increases, the total number of unique users doubled over one month, from 6 500 (mid-January 2014) to 13 000 (mid-February 2014) – although this would have been the period in which students returned to the educational institutions, making up the bulk of the Phase 1 area⁵³ – and doubled again to 29 000, a month later. A highlight of Phase 1 was providing ad hoc public access for spectators of the national presidential inauguration, which was used by 760 onlookers.⁵⁴

In April 2014, just over four months into the project, Isizwe undertook an early survey of users, use and preference, depicting the results as per Figure 2. By this time 29 000 unique devices had accessed the service. With most sites being at educational institutions, the survey indicated the majority of users to be male, between 20 and 29 years of age, with good Internet proficiency and using the service one or more times per day. The top three activities were social media interaction, information inquiries/research and emailing, but accessing news, searching for work and instant messaging were also popular. The most popular requests for unrestricted access were for education, job and news information.

The Tshwane mayor and council were evidently pleased enough with the success of Phase 1, to proceed with authorising Phase 2. Fifty-three million

⁵¹ Knott-Craig Jr, A. (2014). Presentation to Radwin customers, 7 November 2014.

⁵² For further details, see: <http://projectisizwe.org/wp-content/uploads/2014/02/Infograph2.jpg>

⁵³ Tshwane Free Wi-Fi: User summary, 19 February 2014. (Available at: <http://projectisizwe.org/tshwane-free-wi-fi-user-summary>). [November 7, 2015]

⁵⁴ Project Isizwe. (2014). "Free WiFi a success at presidential inauguration". 29 May. (Available at <http://projectisizwe.org/free-wifi-a-success-at-presidential-inauguration/>). [3 December, 2015]

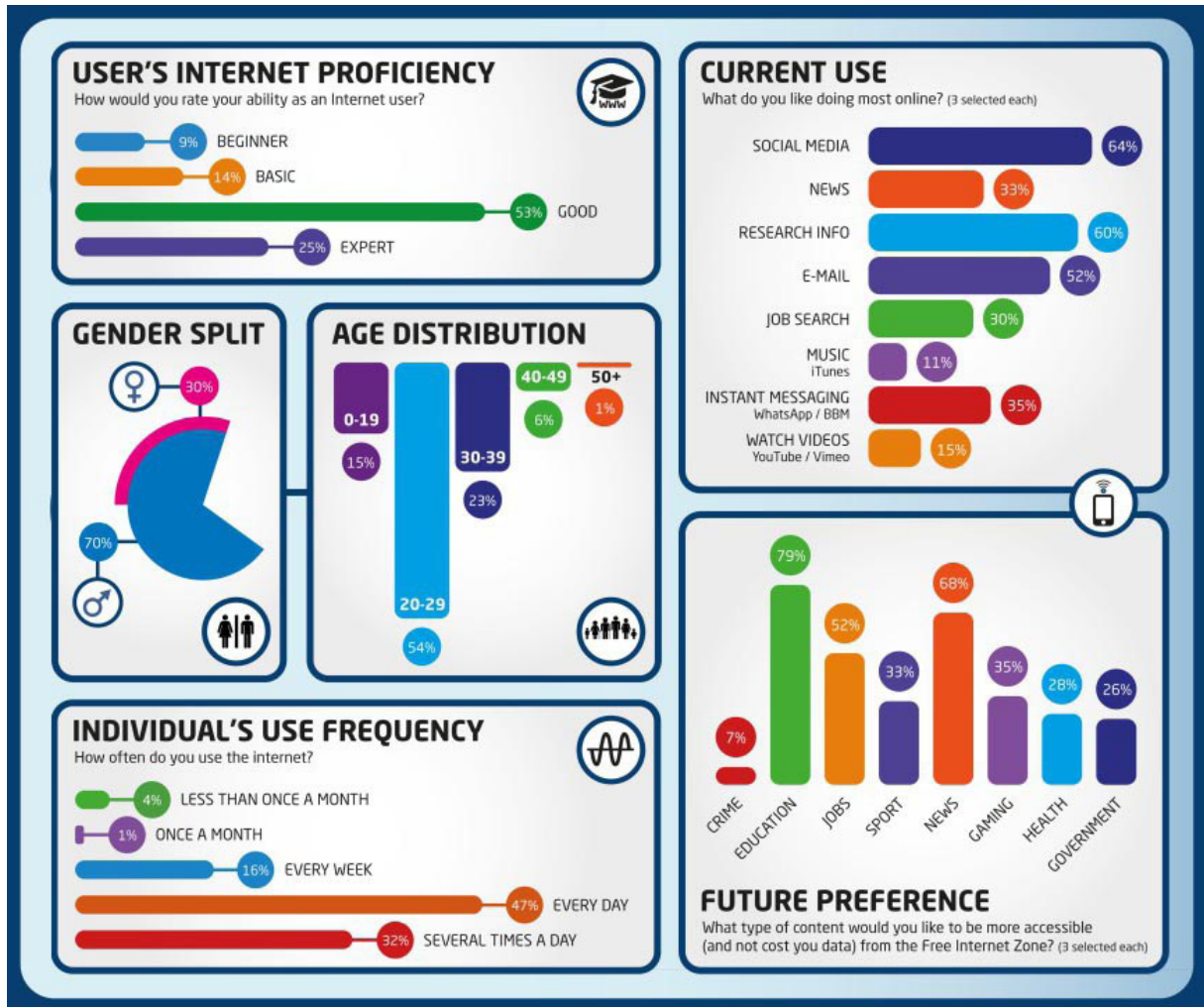


Figure 2: Tshwane use survey (April 2014)

Source: Project Isizwe, 2014.

rand was budgeted for expansion to another 213 sites (translating to about 900 APs) in the CBD and schools in the city's township areas of Atteridgeville, Mamelodi and Soshanguve.⁵⁵ Phase 2 was launched in July 2014.

At this stage, Free Tshwane Wi-Fi had become (and remains) the largest FPW network in Africa.

Low-end Wi-Fi equipment (suppliers being Mikrotik and Ubiquiti) was used to cut costs. Knott-Craig's rationale was that extra costs were not justified by improved performance and that equipment became obsolete rapidly and so needed to be upgraded regularly in any event. During Phase 2, the project switched to use of higher-end hardware. According to the chief technology officer (CTO), administration of APs had "become a nightmare", with over 1 000 now being manually configured.⁵⁶ Ruckus Wireless APs were first introduced for the coverage related to the presidential inauguration (which required a high-density solution). The supplier's equipment lasted longer, was more rugged and the APs self-configured when deployed. At this stage, Ruckus discounted pricing heavily as part of corporate social responsibility. In Phase 2 actual costs were estimated

at R248 000 per site⁵⁷ while R53m was spent on 900 APs which is around R59 000 per AP. This figure nevertheless covered the cost for a 36-month service period including any hardware replacement and capacity upgrades required.

Phase 2 saw a renewed focus on content development. Content from a list of websites is given unrestricted access (over and above the daily bandwidth allocation). This includes health, information (including Wikipedia), employment, education and government websites. A subset of this un-metered content is a curated portal, called Tobetsa.⁵⁸

A related project created video-on-demand content across a variety of magazine, actuality and current affairs topics, but within the Tshwane area. Not only did this provide the services typical of a local television study, but it created revenue opportunities for content producers and provided an interactive platform for elected city officials, including the mayor.⁵⁹ One million views were notched up within three months,⁶⁰ and two million a month later.

Other services offered, or planned, were a curated messaging/chat service (which included forums for discussing city-related issues); a VoIP service,

⁵⁵ Bührmann, A. (2014). "The bright promise of Project Isizwe". ITWeb. 28 February. (Available at: http://www.itweb.co.za/index.php?option=com_content&view=article&id=71257). [8 November, 2015]

⁵⁶ Interview with Project Isizwe's CEO (Khan) and CTO (Devine), Pretoria, 28 January, 2016.

⁵⁷ *Ibid.*

⁵⁸ Project Isizwe. (2014). "Tobetsa Content Portal Goes Live". 31 July. (Available at: <http://projectisizwe.org/tobetsa-content-portal-goes-live/>). [22 December, 2015]

⁵⁹ Project Isizwe. (2014). "City of Tshwane 'Connects Up' to WiFi TV". 31 October 2014. (Available at: <http://www.projectisizwe.org/index.php/2016/06/28/city-of-tshwane-connects-up-to-wifi-tv/>). [21 December, 2015]

⁶⁰ Project Isizwe. (2015). "Infographic: Tshwane Free WiFi goes from strength to strength". 26 February. (Available at: <http://projectisizwe.org/infographic-tshwane-free-wifi-goes-from-strength-to-strength/>). [19 December, 2015]

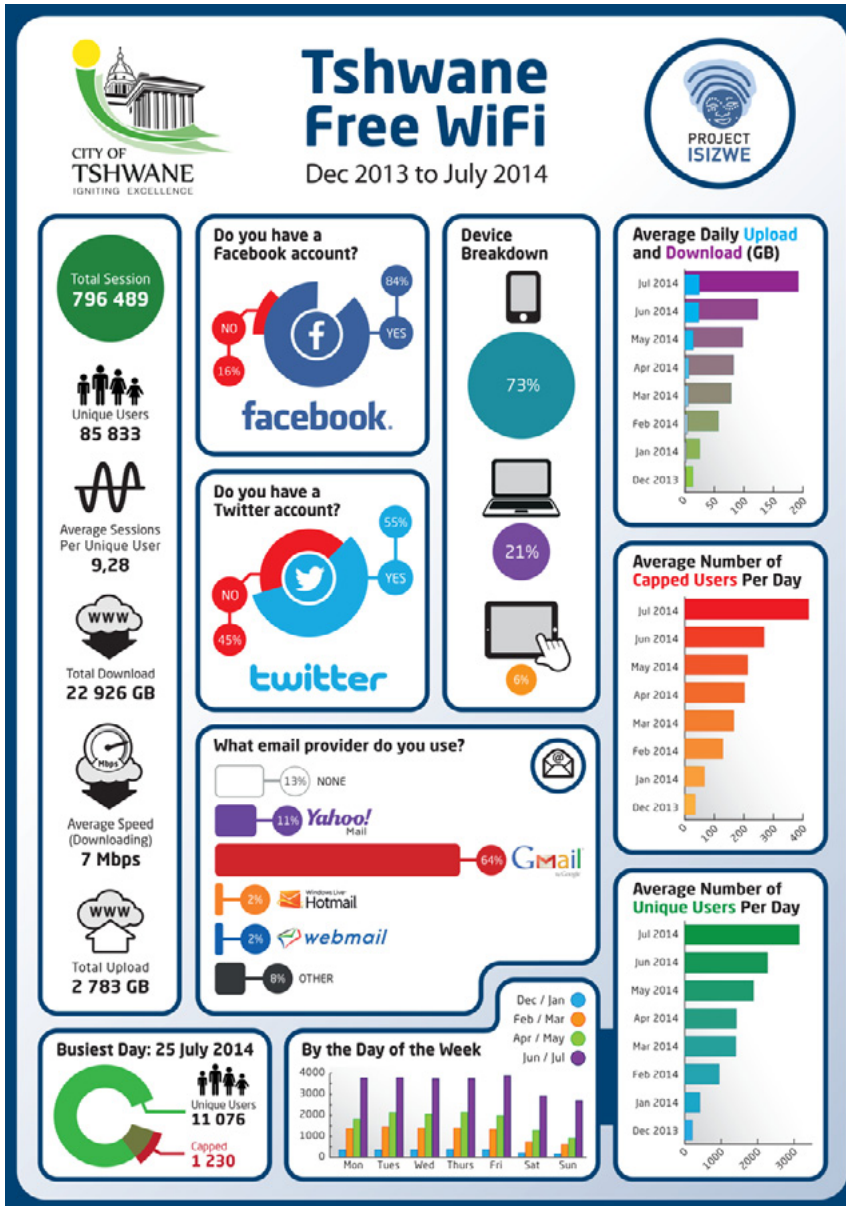


Figure 3: Tshwane Wi-Fi use survey (July 2014)

Source: Project Isizwe, 2014.

enabling users to call each other and the city call centres for free (ultimately included in the same app as the chat); and a future (virtual drive-in) service that will stream sponsored movies onto devices for free at certain times and in certain zones.⁶¹ An independent project by the city (which can be used via cellular or Wi-Fi) was the piloting of a smartphone app for reporting a crime in progress to police.⁶² The app automatically includes the GPS coordinates of the user into the report.

in 2015, the overwhelming majority of users accessed by smartphone (73%) and almost all had a Facebook account (84%). All use indicators had increased, in part due to Phase 2 coverage going live during this analysis period.

By February 2015, 10 million sessions in total were logged, with 400 000 unique users since the launch; 30 000 logging in each day.⁶³

A further innovation in Tshwane was to connect buses on one of the routes which forms part of the rapid transit system, using Radwin's technology to connect buses while in motion and thereby including

them within the free coverage area.⁶⁴ Within three months 80 000 unique users logged on.⁶⁵

Phase 3 was announced in the mayor's May 2015 State of the City Address (SOCA), with 1 848 sites (in addition to the 575 already live, bringing the total to 2 433) to be deployed ultimately in the wider metropolitan area (Tshwane now includes a number of previously independent small towns). He outlined his plan for there to be a site within walking distance of every resident in Tshwane by the end of 2016 (meaning within 1km in an urban area, and within 5km in a rural setting). The mayor indicated that 14.7% of residents were currently within walking distance of the free Wi-Fi service. His ultimate vision was "to eventually provide free Wi-Fi connectivity in every street, every corner and to every household in the Capital City".⁶⁶ The first component of this vision required R100m for 402 additional sites (at least one per ward), based on 800 APs.

Updated infographics at this point showed an increase in the ratio of female users to almost 50%, most of them 24 years old or younger.⁶⁷ The project

⁶¹ McLeod, D. (2015). "Free movies, calls coming to Tshwane Wi-Fi". Techcentral. 11 June. (Available at: <http://www.techcentral.co.za/free-movies-calls-coming-to-tshwane-wi-fi/57389/>). [15 December, 2015]

⁶² Mayor Ramogopa. (2015). "City of Tshwane State of the City Address". 14 May, 2015. (Available at: <http://www.gov.za/speeches/mayor-kgosientso-ramogopa-city-tshwane-state-city-address-14-may-2015-0000>)

⁶³ Project Isizwe. (2015). "Infographic: Tshwane free WiFi goes from strength to strength". 26 February. (Available at: <http://projectisizwe.org/infographic-tshwane-free-wifi-goes-from-strength-to-strength/>). [19 December, 2015]

⁶⁴ Project Isizwe. (2014). "Tshwane hits the road with innovative 'Bus WiFi'". 1 December. (Available at: <http://projectisizwe.org/tshwane-hits-the-road-with-innovative-bus-wifi/>). [23 December, 2015]

⁶⁵ Project Isizwe. (2015). "Infographic: Tshwane Free WiFi goes from strength to strength". 26 February. (Available at: <http://projectisizwe.org/infographic-tshwane-free-wifi-goes-from-strength-to-strength/>). [19 December, 2015]

⁶⁶ Mayor Ramogopa. (2015). "City of Tshwane State of the City Address". 14 May. (Available at: <http://www.gov.za/speeches/mayor-kgosientso-ramogopa-city-tshwane-state-city-address-14-may-2015-0000>)

⁶⁷ Project Isizwe. (2015). "Infographic: Tshwane Free WiFi goes from strength to strength". 26 February. (Available at: <http://projectisizwe.org/infographic-tshwane-free-wifi-goes-from-strength-to-strength/>). [19 December, 2015]

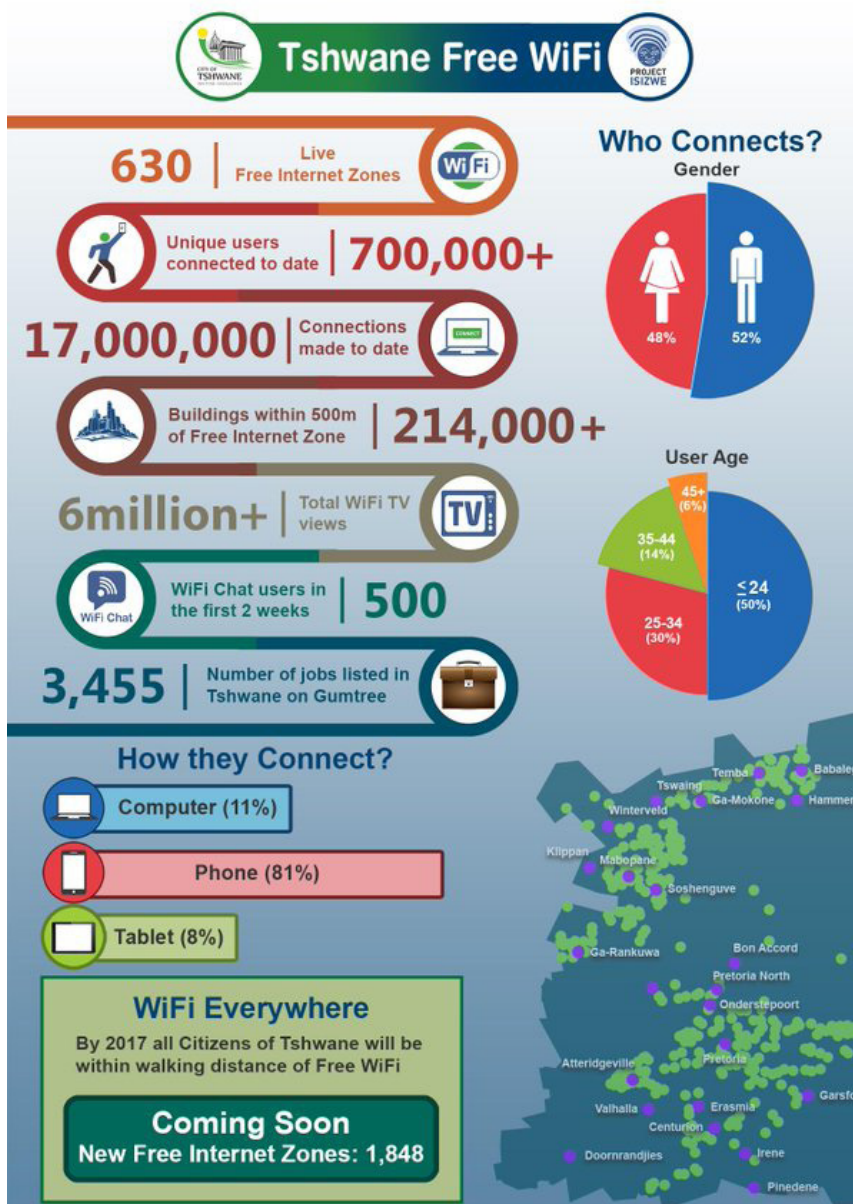


Figure 4: Tshwane use survey (May 2015)

Source: Project Isizwe, 2015.

had recorded 630 000 unique users, or 21% of a population of around 2.9m in Tshwane.

A later infographic for July 2015 shows the same gender split of users, adds a different use split by age (with 80% of users under 35 years old) and adds important information regarding the site type: 81% of sites are educational institutions (Figure 5). Figures released for August, with 705 sites connected, saw a similar gender and age split, with 755 000 unique users, or 26% of the Tshwane population, now having accessed the service.

It was mentioned earlier that Project Isizwe had been exposed to substantial risk, not least from requiring bridging funding. Another innovation worth noting is the use by Isizwe of Social Impact Bonds, which is a private fund of institutional investors that wants to make a positive social difference but also realise commercial returns, offers upfront cash resourcing of government approved projects to expedite deployment.⁶⁸

The daily free allocation of 250MB was recently doubled to 500MB⁶⁹ per device, and the city plans to increase that again for registered users whose rates and local taxes are fully paid up. The data allocation is over and above unlimited access to Tobetsa, the curated content portal. The average speed for downloads was 7Mbps but has been

increased to 15Mbps. An interesting consequence of higher data rates is that certain video-streaming services (including Youtube and Netflix) auto-adjust video quality to match the line-speed. Therefore, streaming video on good quality links (such as those offered by Tshwane Free Wi-Fi) consumes more data than on poor links.

Over the December 2015 period, Tshwane launched a champion's programme – people trained to assist users, collect stories and promote the content portal.⁷⁰ Over Christmas itself (24–26 December), the project allowed unlimited access, due to there being fewer residents in Tshwane over that period.⁷¹

The final infographic was supplied for the end of December 2015 (Figure 6). At the time of writing, Tshwane Free Wi-Fi has significant coverage, with 715 live sites as part of Phase 3, which is an extension of its reach to the lesser-served parts of the municipality. The percentage of educational institutions served has dropped to 72%, probably due to this shift. There is a drop in the ratio of female users by over 100 basis points, which may be linked to the reduced proportion of schools (although any firm inference cannot be made purely by comparing these two infographics). The dominance of smartphones as access devices remains, although the proportion of PCs is at 12%.

⁶⁸ Skelton, D. (2015). "Social impact bonds mooted for Tshwane". 2 June. (Available at: <http://www.timeslive.co.za/scitech/2015/06/02/Social-impact-bonds-mooted-for-Tshwane/>). [18 December, 2015]

⁶⁹ Project Isizwe. (2015). "Tshwane increases Free WiFi daily cap to 500MB". 10 November (Press Release).

⁷⁰ Project Isizwe. (2015). "WiFi Champions program launched". 4 December. (Available at: <http://projectisizwe.org/tshwane-launches-free-wifi-champions-programme/>). [13 December, 2015]

⁷¹ Alfreds, D. (2015). "Christmas bonus for Tshwane Wi-Fi users". 15 December. (Available at: <http://www.fin24.com/Tech/News/christmas-bonus-for-tshwane-wi-fi-users-20151215>). [15 December, 2015]

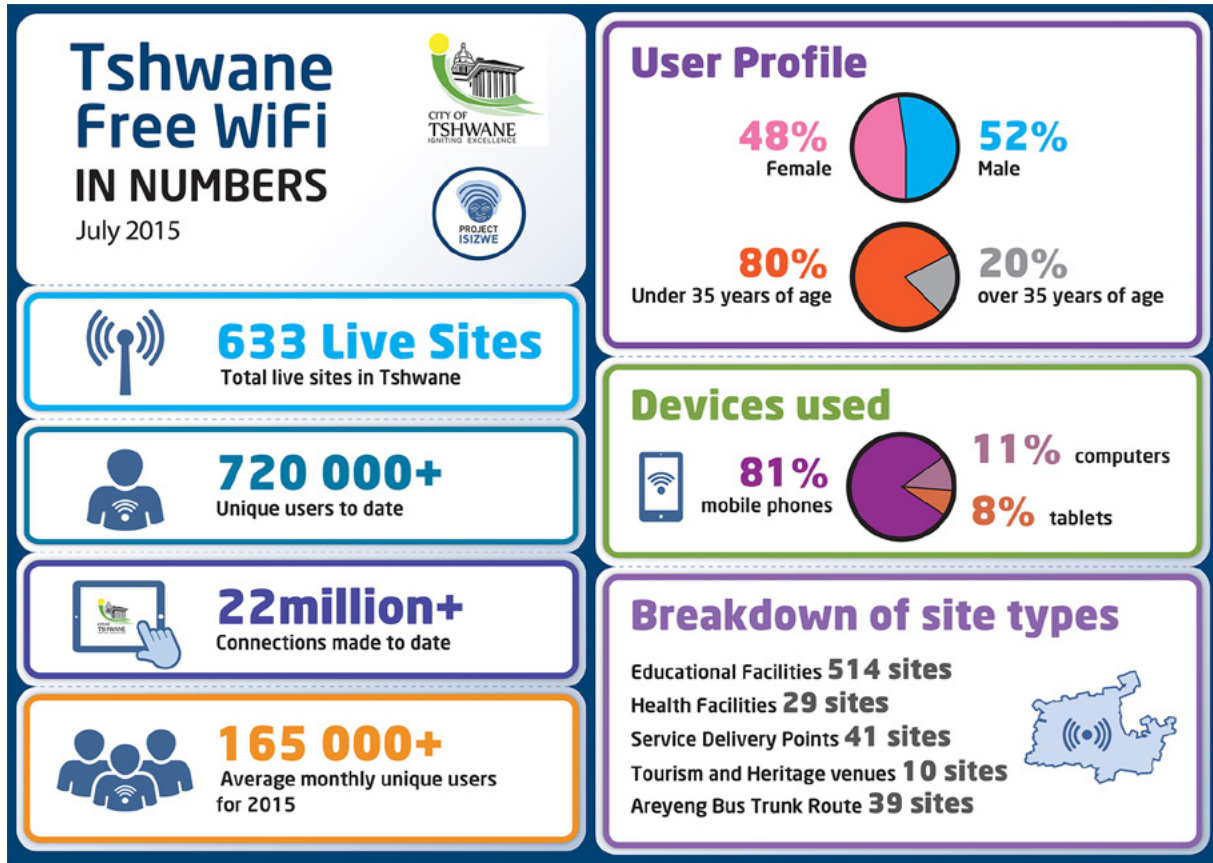


Figure 5: Tshwane use survey (July 2015)

Source: Project Isizwe, 2015.

Within two years, Tshwane, South Africa’s administrative capital city has created the country’s largest FPW network. The project is dynamic and growing and based on a clearly-articulated model. The mayor has laid out the vision for final coverage. The complementary set of activities has created

relevant content and direct local employment opportunities.

The choice of sites is highly skewed to educational institutions. Phase 1 included three tertiary institutions (out of five venues) and Phase 2 was sited at 213 schools. Isizwe’s Eastern Cape project was at two

higher education institutions and all eight sites in the Western Cape were schools. The statistics from Free Tshwane Wi-Fi bear out the strong dominance of student-age users. Tshwane has clearly demonstrated the potential of Wi-Fi to enhance the lives of students. SA Connect includes specific targets for schools (which outnumber other categories of public building). The potential impact of the project on the lives (and future livelihoods) of these students is clear. It will be useful to be able to review Tshwane's impact outside of education and in categories for which the project has consciously catered (such as commuters, young mothers, the unemployed), especially as Phase 3 covers a wider variety of sites.

While the total cost over three years was a hefty R277m (R92m p.a.), it covered the rollout of 700 sites.⁷² Annual costs, therefore, work out to around R131 000 per site⁷³, and, according to the CEO, Zahir Khan, data use costs are "under R1 per GB".⁷⁴

The price covers the network build, and includes data costs. The input costs are reduced, due to an original deal with Neotel to provide a donation of 1Gbps. The second Gbps (needed for Phase 3) was purchased commercially, although at that stage a link procured from Herotel to Teraco also meant that prices could be reduced by peering directly with Google and also other platforms and operators.

Another cost saving is on backhaul. The city gives access to existing fibre infrastructure (including networking). The fibre capacity is also a reason why customers can be offered 15Mbps speeds. Phase 3 may not be connected with fibre, because Tshwane's jurisdiction expanded in 2011 to include two previously independent adjacent municipalities (largely rural), and there have been delays in expanding the fibre network.

Isizwe's price includes three years of maintenance of the network. The maintenance period for Phase 1 will expire in 2017, after which it will own and manage the network itself, exposing itself to the regular market risks of sustainability.

With experience to-date, Isizwe estimated its costs to be R220 000 per site over a 36-month period, based on use of more expensive equipment. On the other hand, the CEO estimated that a "cheap and frugal" site with low capacity and low bandwidth would cost them R60 000 per site per year.⁷⁵

In terms of funding model, historically Isizwe has insisted that free Wi-Fi be fully funded by government. Alfreds quotes Knott-Craig as saying, "Internet access is like water – a utility. The poor should be entitled to a daily free quota. Cities must find the budget to do so. Unlike water, Internet access has a proven multiplier effect on the local economy, resulting in higher tax

⁷² Alfreds, D. (2015). "Christmas bonus for Tshwane Wi-Fi users". 15 December. (Available at: <http://www.fin24.com/Tech/News/christmas-bonus-for-tshwane-wi-fi-users-20151215>). [15 December, 2015]

⁷³ Financial data provided by Project Isizwe (Nov 2016).

⁷⁴ Interview with Project Isizwe's CEO (Khan) and CTO (Devine), Pretoria (28 January, 2016).

⁷⁵ *Ibid.*

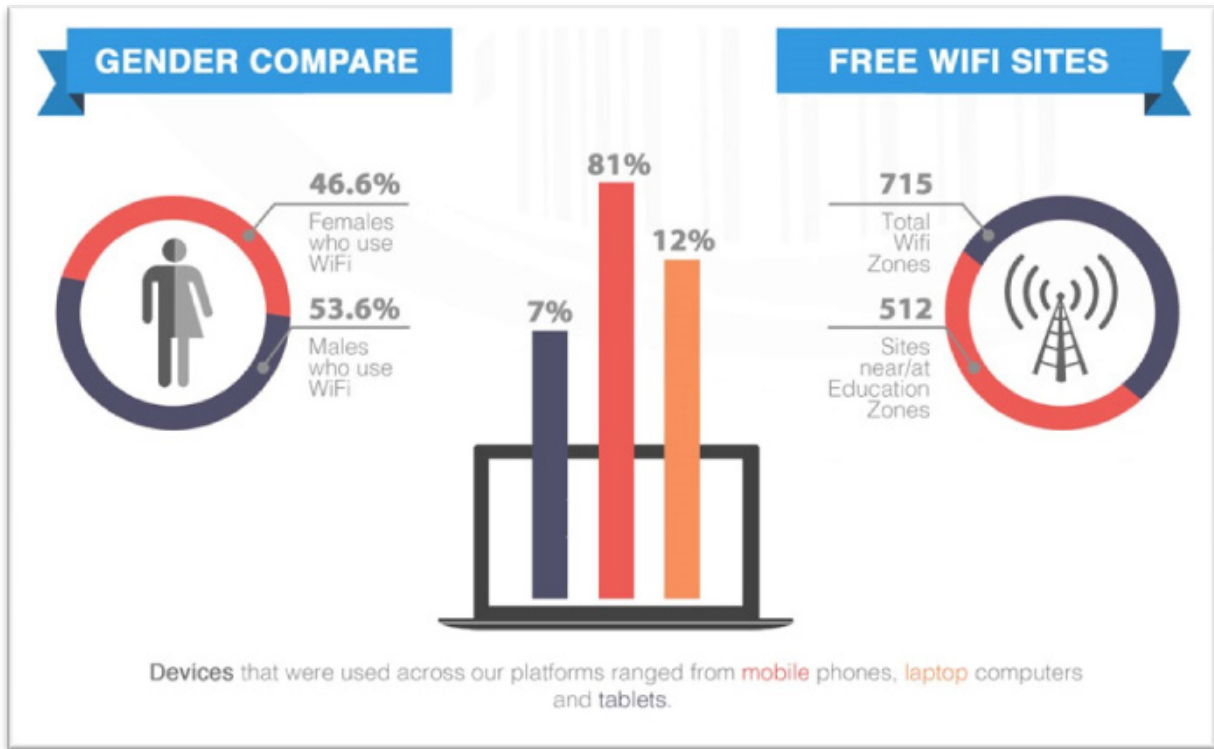


Figure 6: Preliminary evaluation of the Tshwane Free Wi-Fi/Herotel/Project Isizwe Wi-Fi model

Source: Tshwane FPW use survey, December 2015.

revenues”.⁷⁶ Knott-Craig maintains that free Internet access should be guaranteed, as it could benefit the economy or be used as a method to increase collections on unpaid municipal bills.

With reference to the option of selling top-up vouchers to users who have reached their cap, Knott-Craig (who preceded Khan as the CEO of Project Isizwe), vigorously defended Isizwe’s decision not to

do so, maintaining that “Despite the sales propositions of many service providers, in the entire world to date there has not been a successful commercialisation of a public free Wi-Fi network by selling extra data. Ever. Not even airports can monetise Wi-Fi and they have a virtual monopoly on high-income users of the Internet.”⁷⁷ The Project Isizwe website remarked on the Cape Town model of Wi-Fi, saying that “Cape

⁷⁶ *Ibid.*

⁷⁷ Alfreds, D. (2015). “Christmas bonus for Tshwane Wi-Fi users”. 15 December. (Available at: <http://www.fin24.com/Tech/News/christmas-bonus-for-tshwane-wi-fi-users-20151215>). [15 December, 2015]

Town is based upon a ‘paid-for’ model and is primarily targeted at businesses and high-income households. The only model that is 100% guaranteed to fail is selling extra data, i.e. Cape Town.”⁷⁸

Nevertheless, some of the various publically-subsidised models in poor communities around Cape Town, and particularly the Delft public Wi-Fi network⁷⁹ as well as the Digital Village network along the South Coast, are selling additional data vouchers in a “top-up” fashion, as indicated later in this report.

Isizwe’s new CEO, Zahir Khan indicated⁸⁰ that he was open to exploring new income models for future implementations, citing, as an example, Isizwe’s venture with private funding in Limpopo to test the Free Basics model being pioneered by Facebook (discussed later in this Report), which does include voucher top-up options.

Beyond Tshwane, Isizwe attempted, unsuccessfully, to secure contracts for the large Western Cape pilot projects in Khayelitsha and Mitchells Plain, managed by the City of Cape Town (CoCT). The Western Cape provincial authority has, however, successfully engaged Project Isizwe in running one of three pilot projects in two small towns – as is discussed under the

Western Cape section of this report. Isizwe also secured funding from the Open Society Foundation to provide coverage at taxi ranks at Gugulethu and Khayelitsha in Cape Town.⁸¹ The other project awarded is a pilot with the Department of Education at two educational institutions in the rural Eastern Cape (Lusikisiki and Mount Frere)⁸², connected with subsidised satellite backhaul. The pilot aims to connect both the campus and the surrounding community.

Much of the success of Tshwane Free Wi-Fi can be attributed to Project Isizwe’s founder, Knott-Craig Junior. He explains in his publication, “The Story of Tshwane Free Wi-Fi”⁸³ how he had a personal vision for free Wi-Fi, a group of colleagues encouraged him to invest in the vision and he worked hard to make it happen. However, he made it clear from the outset that this was an interim step for him – his personal (oft-repeated) ambition being to own a private jet.⁸⁴ On the back of Project Isizwe he bootstrapped a commercial company, Herotel Telecommunications, which is the provider of all the bandwidth and network services to Tshwane. Knott-Craig resigned as CEO of Project Isizwe, to focus on growing Herotel into a national network, through multiple national acquisitions and partnerships.

⁷⁸ See web reference: <http://projectisizwe.org/faq/>

⁷⁹ Home of Compassion is no longer the appointed technical in the Delft project.

⁸⁰ Interview with Project Isizwe’s CEO (Khan) and CTO (Devine), Pretoria (28 January, 2016).

⁸¹ Project Isizwe. (2015). “OSF-SA partnership: Free WiFi at Gugulethu and Khayelitsha taxi ranks”. 3 August. (Available at: <http://projectisizwe.org/osf-sa-partnership-free-wifi-at-gugulethu-and-khayelitsha-taxi-ranks/>). [12 December, 2015]

⁸² Alfreds, D. (2015). “Rural Eastern Cape to get free Wi-Fi Internet. 25 May. (Available at: <http://www.fin24.com/Tech/News/Rural-Eastern-Cape-to-get-free-Wi-Fi-Internet-20150525>). [6 November, 2015]

⁸³ Knott-Craig Jr, A. and Silber, G. (2015). “The story of Tshwane Free WiFi”. (Available at: <http://www.projectisizwe.org/wp-content/uploads/2016/06/1-The-Story-of-Tshwane-Free-WiFi.pdf>)

⁸⁴ One example being Knott-Craig Jr. video interview on CNBC Africa Power Lunch, 4 June 2014. (Available at: <http://www.biznews.com/interviews/2014/06/04/alan-knott-craig-2/>). [22 December 2015]

To some extent, the future of Tshwane Free Wi-Fi depends on Khan's capability as new CEO of Project, how effectively the non-profit organisation has transitioned from start-up to a larger organisation and how well Herotel Telecoms will maintain network support as it changes its focus to a large new venture. It is not clear how the physical network elements of the free Wi-Fi network can and will be split, as 36-month operations agreements relating to the project phases come up for renewal. Isizwe also surely needs to find other project sponsors soon (beyond Tshwane).

On Tshwane's side, the project has been very closely associated with the mayor (as a strong, personal sponsor with vision). Tshwane Free Wi-Fi was a significant factor in the 2016 local government elections as an example of delivery by the African National Congress, which controlled the metro.

City of Johannesburg

The City of Johannesburg has a long-standing broadband and "smart city" initiative managed by its Department of Economic Development. The primary deliverable is fibre deployment (with the city as anchor tenant), with free public access to be deployed via the so-called Smart Wi-Fi Project.

In April 2014, Parks Tau, then mayor of Johannesburg, announced that he was committed to deploying 1 000 public hotspots by the end of his term in 2016.⁸⁵ Tau's

announcement was made at the opening of the first live site at Orlando Communal Hall in Soweto and of nine Rea Vaya (public bus) stations on the routes between Soweto and Johannesburg city centre. Tau announced that 85 of these sites would be libraries, to be completed by the end of 2014. He promised to train 1 000 students per year in ICT so that they could support the overall broadband dissemination programme.

A detailed presentation given by Zolani Matebese (the city's head of broadband), which he delivered at South Africa's Wi-Fi Alliance conference⁸⁶, outlined the economic benefits of the overall programme. The programme includes a number of ICT-promoting elements, including SMME incubation (in partnership with the University of Witwatersrand) and a "Joburg Hackathon".⁸⁷ Matebese confirmed (in the question and answer session of the conference) that the mayor remained committed to providing the 1 000 hotspots by 2016 and that he wanted "the best free Wi-Fi in the world" – translating to access speeds of over 10Mbps for each device and capped at 300MB per day. At the time of writing, there are over 400 free Wi-Fi hotspots available in Johannesburg.⁸⁸ These included coverage announced in Braamfontein (a popular section of Johannesburg city centre, which includes Johannesburg government buildings and a section of Wits University Campus) as well as the 9 Rea Vaya (public bus) stops between Johannesburg City Centre and Soweto.

⁸⁵ Mybroadband. (2015). "Free Wi-Fi for Johannesburg". April 15. (Available at: <http://mybroadband.co.za/news/Internet/100684-free-wi-fi-comes-to-joburg.html>). [4 December, 2015]

⁸⁶ Matebese, Z. (2015). "Broadband, Wifi & Economic Growth". Presentation at Wi-Fi Alliance conference. February.

⁸⁷ Mybroadband. (2014). "Free Wi-Fi for Johannesburg". April 15. (Available at: <http://mybroadband.co.za/news/Internet/100684-free-wi-fi-comes-to-joburg.html>). [4 December, 2015]

⁸⁸ Jozi Digital Ambassadors (n.d.) "Free WiFi". (Available at: http://digitalambassadors.org.za/#_fw). [20 October 2016]

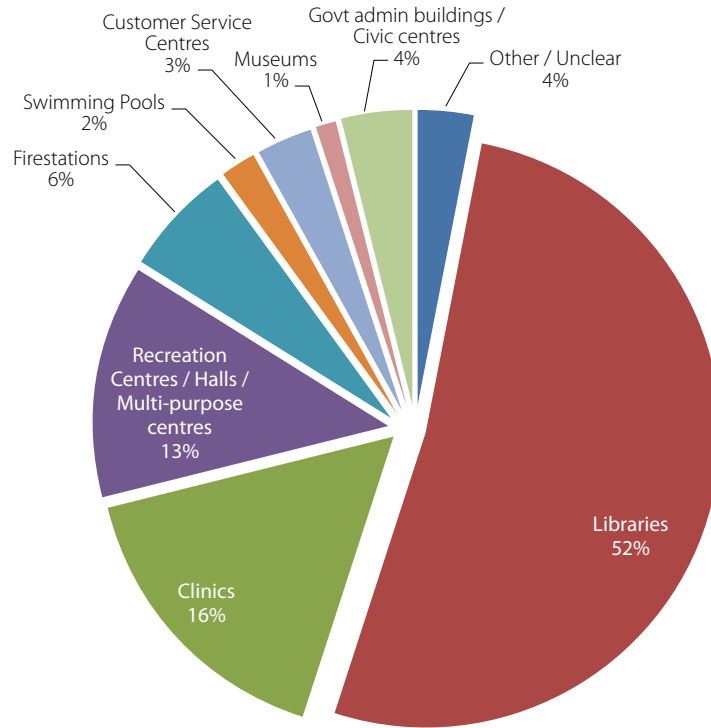


Figure 7: Breakdown of Venue Types for Johannesburg Wi-Fi (November 2015)

Source: City of Johannesburg, 2015

It may be that the three categories of public buildings are higher in frequency because they were targeted for priority deployment. The final breakdown may be different. The breakdown to-date shows that more than half the sites connected thus far are libraries, which are mentioned as a target in the original announcement. Libraries are synonymous with learning and information and are also used as study centres by students, after school.

The next highest category is clinics, representing 16% of the total. Clinics are usually well attended and their clientele includes vulnerable groups. SA Connect specifically targets clinics for connectivity. The third highest location choice is a combined category of recreation centres, halls and multi-purpose centres. These venues are used for regular and one-off events and may house community-oriented NPOs.

In terms of target areas, a number of the sites are in Soweto, and in other low-income areas, such as Alexandra, Orange Farm and Yeoville. However, there are also deployments in suburbs such as Emmarentia, Parkhurst and Parkview, areas wealthy enough to have already spearheaded fibre-to-the-home deployments and to negotiate their own free Wi-Fi services in public areas.

Johannesburg regularly tweets updates on its plans to have 1 000 sites connected.⁸⁹ In December 2015, the city reported on its Facebook page that 3 000 youth were selected and in training to “become Jozi Digital Ambassadors to train residents to use Joburgwifi”.⁷⁰ The project was to have been completed in the course of 2016.

In looking at the project, it appears that the concept of providing 1 000 public hotspots is ambitious. Motabese’s comments highlight an element of rivalry, with Johannesburg explicitly wanting to offer larger daily caps and faster download speeds than other larger cities.

The downfall of the project has been its execution. Initial delays and additional costs were inevitable, due to complications with the original fibre network.⁹¹ Although a private sector consortium was awarded the tender in 2011, contractual disputes and performance-related

issues have delayed rollout of even the basic dark-fibre services.

Ekurhuleni

A more recent deployment is in the city of Ekurhuleni’s free Wi-Fi project, where a public launch was held in November 2015.⁹² Ekurhuleni adjoins Johannesburg and is close to Tshwane, with the three metropolises combined effectively forming the economic centre of South Africa.

The project is rooted within the city’s wider “Digital City Framework”, which contemplates multiple interventions at all telecommunications levels, from an optimal mix of physical bearers through to switching, data storage and management, and up to applications for citizens (smart everything: security, traffic, government, emergency communication, healthcare, education, citizen interaction, campus and building). By far the most significant early project is that connecting buildings with fibre. Wi-Fi is run on the back of that project.

The Wi-Fi project commenced in January 2015, was launched in November 2015 (so that citizens could use the sites deployed to-date) and aims to be complete by January 2018. The budget is R120m, of which R25m had been spent at the time of the launch. This budget should provide access

⁸⁹ Tweets from City of Joburg (@CityofJoburgZA). Revised project completion tweeted on 13 December, 2015.

⁹⁰ City of Johannesburg Facebook Page. (Available at: <https://www.facebook.com/CityofJohannesburg/>). [posted and accessed 19 December, 2015]

⁹¹ Czernowalow, M. (2015). “ITWeb investigates: Joburg’s R1.2bn broadband ‘white elephant’”. 6 February. (Available at: http://www.itweb.co.za/index.php?option=com_content&view=article&id=140971). [19 December 2015]

⁹² Alfreds, D. (2015). “Ekurhuleni switches on free public Wi-Fi”. 19 November. (Available at: <http://www.fin24.com/Tech/News/ekurhuleni-switches-on-free-public-wi-fi-20151119>). [20 November, 2015]

at 695 public buildings, once these buildings are connected via fibre. The service is free to the public, with a daily cap of 250MB. The city's stated aim is to achieve this with a spend of under R0.05 per MB.⁹³

The Ekurhuleni authorities looked at options of buying, building or leasing for its infrastructure. It chose to put the project to tender, resulting in the appointment of wireless systems integrator Altech Alcom Matoma, together with black-owned service provider MMIV.⁹⁴ Alcom Matoma is the service provider for Gauteng's broadband deployment. Project Isizwe submitted an application, and the Ekurhuleni authorities visited their flagship deployment in Tshwane, but the bid was not successful. The tender adjudication deliberation detail is not public information but the city's ICT Business Relation Management Divisional Head pointed out that Ekurhuleni's requirements were different from those of Tshwane. The Tshwane Wi-Fi

network was purpose-built and third-party managed, whereas Ekurhuleni wanted to retain ownership of its significant network (based on 900km of fibre) to connect its buildings, of which the Wi-Fi component was a modest, albeit integral, part.⁹⁵

The project recognises five different building types: libraries, clinics, customer care centres, campus buildings (which can be four or five floors), and smaller sites (such as pools and parks). Libraries were prioritised and then clinics. Customer care centres, which are at the heart of communities, were to be rollout in 2016. Progress on deployment of priority building types and totals is given in Table 4.

Poorer areas were targeted for early deployment (Katlhlong and Thembisa, for example, although Benoni is also included to-date). In prioritising deployment, attention is given to criteria such as footfall, and also the existence of houses immediately

Type of building	Completed	Total	% complete
Libraries	19	45	42%
Clinics	30	120	25%
Total sites	200	695	29%
Total APs	925	3 000	31%

Table 4: Ekurhuleni Wi-Fi deployment progress (by November 2015)

Source: Ekurhuleni municipality, 2015.

⁹³ Nthlophi, L. (2015). "Introducing Ekurhuleni Free Wi-Fi" (PowerPoint presentation providing a status reporting update as at November 30, 2015).

⁹⁴ For company information, go to www.mmiv.co.za.

⁹⁵ Interview with Lydia Ntlhophi, City of Ekurhuleni ICT Business Relation Management Divisional Head. 23 December, 2015.

around public buildings (since access can be provided up to a nominal 200m radius).

Data supplied for the pre-launch period from September 2015 until launch (19 November 2015) indicates there were 124 217 users, averaging 86MB download per user, with 13 059 reaching their cap. Total use to that date had been 12.05 TB.⁹⁶ It was reported that even though 650 attended the launch event and could connect to the Wi-Fi at the venue, download speeds were at 125Mbps.⁹⁷

An application the city has developed within its framework is called e-siyakhokha, which enables citizens to pay for services online. Self-service applications are in development, as well as various ehealth modules – such as doctor appointment reminders.

Ekurhuleni is an innovative authority. An earlier Wi-Fi project had been initiated, but gave inconsistent quality of the service, resulting from the poor connectivity service to buildings. This connectivity problem is now being addressed with the fibre network.⁹⁸ According to Ntlhophi⁹⁹, there is integration with Gauteng's plans and connectivity also needs to be carefully managed by adjacent cities and the province to ensure there is no overlap at buildings along boundaries. Progress is reported to national government and the South African cities that have implemented Wi-Fi do compare

experiences. Ntlhophi also indicated that, with the project in deployment for over 2016 and 2017, there were no immediate plans regarding the next step, but that these could take the form of extending connectivity beyond public buildings.

The internal learning is to provide Wi-Fi after establishing quality backhaul connections, as the current project provides. A level of use data was provided, but the city should request more detailed analytics from its suppliers, in order to better understand the impact and use and allow for a more detailed review. This is being applied going forward.

Ekurhuleni has set a target cost of R0.05 per MB consumed, which would equate to R51.20 per GB. This target can be measured at project conclusion. This cost is 50 times that reported by Tshwane Free Wi-Fi. It amounts to R12.80 per user, per day; or R389 per person, per month (if the user reaches caps). Such a “municipal subsidy” would be higher than the government's early childhood subsidy (which amounts to R330 per month¹⁰⁰), and several times higher than the household (rather than per person) subsidy offered for water (which is 6Kl per household, or around R40–R60 per month) or for electricity (which is 50kW per household, or around R75–R100 per month). In addition, the Ekurhuleni target cost equates to the current retail

⁹⁶ It appears from the data format, that a “user” was defined as a specific device accessing the network on a particular day. In other words, if the device connected the following day, it would be counted as another user.

⁹⁷ Alfreds, D. (2015). “Ekurhuleni switches on free public Wi-Fi”. 19 November. (Available at: <http://www.fin24.com/Tech/News/ekurhuleni-switches-on-free-public-wi-fi-20151119>) [20 November, 2015]

⁹⁸ *Ibid.*

⁹⁹ *Ibid.*

¹⁰⁰ President Jacob Zuma. (2015). “End-of-the-year statement”. (Available on <http://www.gov.za/speeches/president-jacob-zuma-end-year-statement-18-dec-2015-0000>) [19 December, 2015]

commercial offerings from Wi-Fi service provider AlwaysOn (for a 5GB package) but is more expensive than the AlwaysOn monthly offer.¹⁰¹ One could argue that the context is different, but that would not account sufficiently for the premium.

PROVINCE OF WESTERN CAPE¹⁰²

The Western Cape is South Africa's fourth largest province by population, with 5.8m inhabitants, about two-thirds of whom live in the metropolitan area of the capital, Cape Town.

Broadband within the Cape Town metropole is the responsibility of the CoCT authority whereas broadband within smaller towns and rural areas is promoted by the Western Cape provincial authority, the Department of Economic Development and Tourism (DEDAT), and implemented by Home of Compassion, Digital Village and Project Isizwe.¹⁰³

DEDAT commenced planning and operations after the CoCT had already commenced with its own ICT strategy, and has taken an integrative approach to working with the city, both in general and through a joint effort, entitled the "Digital Inclusion Project", initiated in 2011.

Impetus to plan for the promotion of broadband came from the creative industries – especially the filming industry, which was growing and globally competitive, but saw itself falling behind - with broadband costs

and quality as one of the constraints. Research with stakeholders from 2009 led to Government embarking on an ambitious plan for the province.

A broadband strategic framework and integrated master plan were developed to promote the use and benefits of broadband in the province. The vision is for everyone to have access to affordable broadband, and the requisite skills to be using it, by 2030. The strategy considers multiple aspects, along the triple themes of connected government, connected citizens and connected households. The strategy was based on the "Digital Readiness" index and surveys which had been undertaken by Research ICT Africa. Research ICT Africa had adapted the World Economic Forum model to include a demand-side household and individual survey of access, and had devised a number of other strategies to get province-specific data on infrastructure rollout and coverage, ICT education, promotion of ICT-dependent industries and ICT in various government services.

The Wi-Fi projects in the Western Cape are distinguished in that they are not regarded as end projects, but a variety of pilots that can be compared as a learning process, as well as catalysts to encourage private sector investment in the provision of FPW and justify any future public investment where required.

The main project arising from the strategy was a fibre-connectivity project. It was supported by a

¹⁰¹ The cost per GB is nearly four times higher than their offer equating to 100MB per day for R39 per month, but equates to their one-off purchase price of 5GB for R250.

¹⁰² Most of the information for the Western Cape provincial projects results from a face-to-face interview with Marc Cloete, a programme manager for Wi-Fi deployment, 8 December 2015.

¹⁰³ Interview with Jo-Anne Johnson, Chief Director, Western Cape Government, 2016.

sophisticated economic model that demonstrated the potential of broadband penetration to drive economic growth, job creation and regional competitiveness (among other benefits). However, the study that clinched urgent action was one based on coordinated procurement, which demonstrated immediate and significant ICT savings by government. The Western Cape put out a tender for a public-private partnership (PPP), resulting in the appointment of telco operator Neotel to deploy the physical network and maintain it for 10 years. The agreed pricing confirmed that the predicted savings could be realised. The final negotiation allowed for inclusion of Wi-Fi hotspots at sites to be nominated by the provincial authority.

Prior to the fibre deployment project (currently underway), the province had initiated three pilot

sites, in order to fine-tune and develop a longer-term model. It was decided to engage NPOs as they allow increased financial transparency, although it was understood this could be at a higher cost. The NPOs with the best proposals were awarded grants for R2m each and up to R200 000 in year 1. In years two and three the networks were to be self-funding.¹⁰⁴ The NPOs were permitted to seek additional funding from local sponsorships, for example, to expand their projects. Each of the NPOs uses an underlying ISP for the technical service.

Most of these 52 sites went live in September 2014 and all APs are now deployed. Information is being gathered from these pilot projects in order to gain further experience.

Project Isizwe pilots are the most expensive to

Area	Service provider	# APs	Underlying provider	Users (devices) in Nov 2015	Daily MB allowance per device	Info
Garden Route	Digital Village	24	Cloud Connect (now acquired by Herotel)	75 100	250	
Delft	Home of Compassion	20	Wish Networks	17 150	50	They sell prepaid top-up vouchers.
Atlantis and Robertson	Project Isizwe	8	Herotel	30 000	250	

Table 5: Western Cape pilot projects

Source: Cloete interview, 2015.

¹⁰⁴ Western Cape Government's Department of Economic Development and Tourism (DEDAT). (2013). "Call for Applications for Funding of Free WiFi Projects (to NPO's). Terms of Reference". 11 November.

build, which is one of the reasons why fewer APs were installed. The Isizwe sites are based at four schools in the low-income areas of Robertson and Atlantis, providing access to nearly 10 000 students.¹⁰⁵ Isizwe says the reason for the costly build is they complied most closely with the original requirements in DEDAT's invitation. As shown in the table above, two of the projects offer 250MB per device per day. Home of Compassion offers only 50MB, and sells vouchers for customers wishing to top up for further use.

The second pilot project by DEDAT is run in conjunction with Neotel, responsible for the fibre deployment. In this model (which piggy-backs on the tender awarded to Neotel for fibre rollout), the partner funds the Wi-Fi infrastructure, whereas Western Cape funds the daily free data allocation.

The overall fibre project targets 1 964 government building sites for connection with fibre or wireless (point-to-point) connectivity. Under the terms of the overall tender, Neotel deploys and owns its network and provides connectivity/access services to government with pre-agreed deployment schedules and pricing. Neotel is therefore at liberty to sell services to non-government clients, using the same fibre network.

The Wi-Fi component is aimed at one AP for each ward, or 384 sites in total, which Neotel will build, manage and maintain for three years, offering 250MB per device, per day, at 2mpbs minimum speed.¹⁰⁶

Access to government websites (the gov.za domain) is not metered or limited. Neotel can sell Wi-Fi data bundles beyond the 250MB, if it so wishes, or provide its own commercial Wi-Fi services.

The first round of sites was selected in 2015 and 50 more were to be added by March 2016, for the official launch in March. Another 50 should be operational 12 months after that, and all 384 should be operational by the end of February 2018. Wi-Fi sites could only be chosen from the set of sites connected in the first round of Neotel's fibre deployment. The breakdown for the first 366 sites chosen is shown in the table below.

Department	Wi-Fi hotspot sites
Education (mainly schools)	152
Cultural Affairs and Sports (libraries)	128
Health (clinics and hospitals)	67
Social Development	9
Transport and Public Works	6
Dept of the Premier (mainly Thusong Centres)	4

Table 6: Breakdown of venue types for Western Cape Wi-Fi (December 2015)

Source: Cloete interview, 2015.

¹⁰⁵ Project Isizwe. (2014). "Project Isizwe launches Western Cape sites". 28 August. (Available at: <http://projectisizwe.org/project-isizwe-launches-western-cape-sites/>)[20 December, 2015]

¹⁰⁶ The Access Point (AP) refers to the physical equipment, which is connected to a high site and provides Wi-Fi connectivity to customers. Another common term is a 'hotspot'. An area offering Wi-Fi (sometimes called a Wi-Fi Zone) may be served by one or more access points. Therefore, there are usually more access points in a network than there are Wi-Fi areas or Wi-Fi Zones.

The constraint of having one AP in every ward often resulted in only a single building being eligible. Consideration was also given to reasonable geographic spacing between APs. Finally, the type of site was considered. This also took into account the fact that there is a separate schools Wi-Fi project underway, and that the libraries and Cape Access centres are also working on Wi-Fi projects. Neotel has only agreed to provide Wi-Fi APs at venues on its fibre network, but has been requested to also consider sites that it is serving via the fixed-wireless portion of its network. Most of the APs are located at educational institutions, libraries and health facilities.

The expected benefits listed are as follows:

- provision of information and transaction capability (including for job seeking)
- educational
- safety
- service delivery
- decrease in digital divide.

The provincial government has appointed two local champions per AP, to work for six months from when a site goes live. These champions have been trained and given a laptop loaded with training videos and questionnaires. They initially promote use and collect information, and then move from the ward to key target group locations (such as churches or clubs). They will map other Internet access services and APs in the ward. In addition, they are tasked to liaise across government departments on deployment and operations.¹⁰⁷

¹⁰⁷ Interview with Jo-Anne Johnson, Chief Director, Western Cape Government, 2016.

In DEDAT's view, the two pilot projects are not necessarily aimed to be sustainable, but to facilitate learning about what future interventions to make, to demonstrate the economic possibilities of Wi-Fi, to stimulate demand, to provide connectivity where there is currently none, and to reduce risk for the players involved in the pilots, in the hopes that they will themselves invest further based on their learnings from the pilots.

Information from the projects that could be used to assess sustainability is currently limited. Top sites listed in November were Google, Tubidy (a music video and audio download site) and Avast (an antivirus site).

According to DEDAT, Cape Town is a population-dense metro which means service take-up will be good. The metro can thus install fibre at relatively low investment cost (i.e. of owning the fibre) and allow multiple ISPs to compete with services in a lucrative market (open access). The Wi-Fi model that follows is identical (city owns the fibre and allows ISPs to have open access). By contrast, the Western Cape is population-sparse which means service take-up will be low. The province therefore shares the cost of fibre installation (by PPP), but mitigates the risk (to attract investors) by creating demand as the anchor tenant. The Wi-Fi model that follows is also identical (private partner builds and operates the hotspots but province creates demand by paying for public use).

City of Cape Town (CoCT)

The municipal authority (CoCT)¹⁰⁸ conceived an open access fibre network over 10 years ago (with the twin objectives of connecting public buildings and selling wholesale access to ISPs). Tenders went out in 2006, and the fibre network is operational and is already said to have achieved considerable savings.

As part of its overall strategy, CoCT has a number of initiatives, including provision of free Wi-Fi in selected public spaces since 2013 (such as the Company Gardens park and public bus stops across the city). Another initiative that is run in conjunction with the Western Cape Government is the Digital Inclusion Project¹⁰⁹, the goal of which is to make broadband Internet access more available to households in under-served communities.

In order to develop its strategy, CoCT undertook a feasibility study – funded by the United States Trade and Development Agency – into the provision of broadband in two areas in Cape Town; Khayelitsha and Mitchells Plain. The study recommended that broadband be delivered via Wi-Fi, resulting in a proof of concept (POC) by CoCT in 2014 to provide Wi-Fi via public hotspots on an open access basis. The POC aimed to achieve the following.

- Test and understand the performance and functional suitability of Wi-Fi as an access technology.
- Test and understand the possible role of other available technologies, viz. GSM, CDMA (including WCDMA) and WiMax.
- Measure end-user uptake and gauge user experience, including elasticity of demand.
- Measure and quantify the capital costs involved in deploying the necessary last-mile passive and active infrastructure.
- Measure and understand the operating costs to both the city and commercial service providers.
- Understand the possible contractual and commercial relationships that could be established between the city and commercial service providers.
- Inform future initiatives, including suitable business models and technologies for possible expansion.
- Establish a viable rollout plan for expanded service provision that ensures that the targeted communities have access to the intended services in a sustainable way.¹¹⁰

The project took advantage of the CoCT fibre project

¹⁰⁸ Unless otherwise indicated, the information for this section derives from a meeting with the Cape Town Wi-Fi project team (chaired by Leon van Wyk), and follow-up information provided by Raven Naidoo, including the case study (Naidoo, R. *et al.* "Case study: Public Internet access using Wi-Fi. Results of a Proof of Concept project carried out in Khayelitsha and Mitchells Plain". City of Cape Town. Undated.)

¹⁰⁹ Naidoo, R. *et al.* (Undated). "Case study: Public Internet access using Wi-Fi. Results of a Proof of Concept project carried out in Khayelitsha and Mitchells Plain". City of Cape Town.

¹¹⁰ *Ibid.*

for backhaul, extending wireless backhaul spurs where necessary. Distinguishing features of the project appear to be:

- It targeted two specific areas known to have very low Internet uptake.
- It aimed to provide coverage outside of (rather than at) public buildings (or facilities). Public buildings were used where appropriate, but high masts were deployed to extend coverage, and additional masts were also deployed away from public buildings.
- The Wi-Fi APs were “open access” in that they allowed multiple ISPs to offer Internet services. A commercial tender process (request for quotes) was, therefore, based on providing the ISP portion of the service rather than provisioning infrastructure. ISPs were able to provide services via a simple cross-connect to the CoCT’s main switching centre, and therefore did not have to pay infrastructure costs beyond Internet provision itself.
- The other main service provider for the project design and deployment, Duxbury, was an existing CoCT service provider (appointed for its LAN deployment).

For the first year of the POC, from January 2014 to January 2015, the city used its own internal Internet service provider (Smartcape) to provide access, offering 50MB per device, per day. Two sites became operational from January, and the uptake grew by

over 10% per month, until June, when another two sites became operational. From January 2015, three service providers (who had then been appointed by tender) offered service. These were MWEB, AlwaysOn (owned by Internet Solutions) and Orange. Due to a merger with AlwaysOn, MWEB ceased to provide service from April 2015.

CoCT stipulated a minimum 50MB daily free data allowance per device (the bundle size Smartcape had provided). However, operators offered a greater bundle size, which (as will be discussed in the project review) had unintended consequences in terms of the service provision. The daily free data allowances per device and data speeds provided by the ISPs (the total Internet bandwidth each one allowed for at the point of cross-connect) are given for the early and latter part of 2015 in Table 7.

ISP	Daily MB allowance/ device Jan – May 2015	Daily MB allowance/ device May – Sept 2015	Data speed of cross-connect
MWEB	Uncapped	Ceased to operate	1 Gbps
Orange	3GB	500MB	10Mbps
AlwaysOn	50MB	250MB	100Mbps

Table 7: Data speeds and daily allowances per ISP - January 2015

Source: City of Cape Town, 2015.

Orange reduced their daily allowance by 84% at that point, while AlwaysOn increased its allowance by 400%. AlwaysOn settled with half the allowance, but at 10 times the total throughput speeds.

The CoCT has provided snapshots of data volumes by provider as well as use type, at various times.

Each of the following figures shows the total downloads for the month, by service provider, with the same information represented graphically by circle size. The figures also show the top applications and data downloaded for that month, again with this information represented graphically by circle size. The information not available is the number of unique users.

Table 7 shows the impact of MWEB having the

fastest downloads and offering uncapped access. MWEB moved 26 times more data than its nearest rival and gained almost 96% market share (in terms of data volumes). The predominant application, by far, was BitTorrent (peer-to-peer file sharing). The next significant application was YouTube. Over 2.6 times more data was downloaded on BitTorrent than YouTube and over 3.5 times more data on YouTube than the next most popular application (Google Drive). Facebook was the most popular social network application (by data volume). Significant data was consumed in watching restricted video content (XVideos). Google searches were popular, and the balance was used to update software.

January 2015

MWeb = Uncapped @ 1Gbps
 Orange = 3GB/day @ 10Mbps
 AlwaysOn = 50MB/day @ 100Mbps

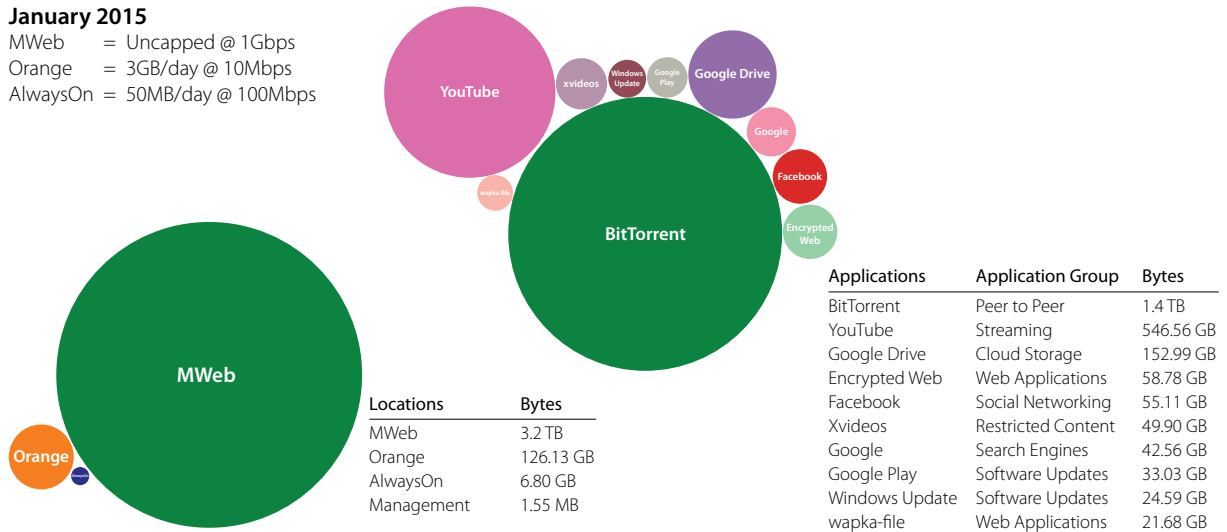


Figure 8: CoCT use for January 2015

Source: City of Cape Town, 2015.

February 2015

MWeb = Uncapped @ 1Gbps
 Orange = 3GB/day @ 10Mbps
 AlwaysOn = 50MB/day @ 100Mbps

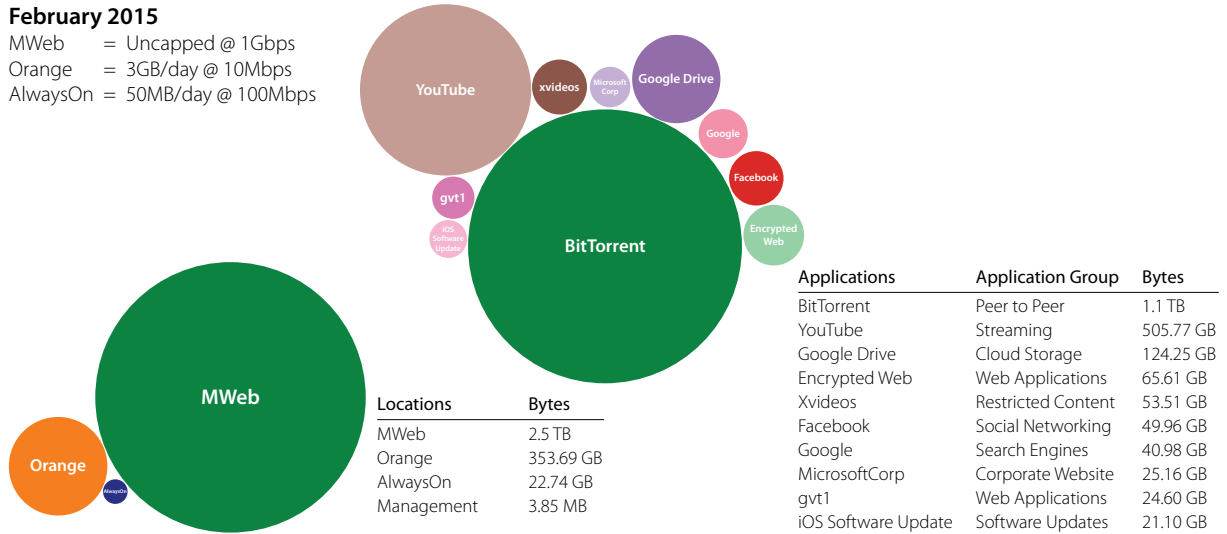


Figure 9: CoCT use for January 2015

Source: City of Cape Town, 2015.

March 2015

MWeb = Uncapped @ 1Gbps
 Orange = 3GB/day @ 10Mbps
 AlwaysOn = 50MB/day @ 100Mbps

(MWeb stopped providing service on the 26th of March)

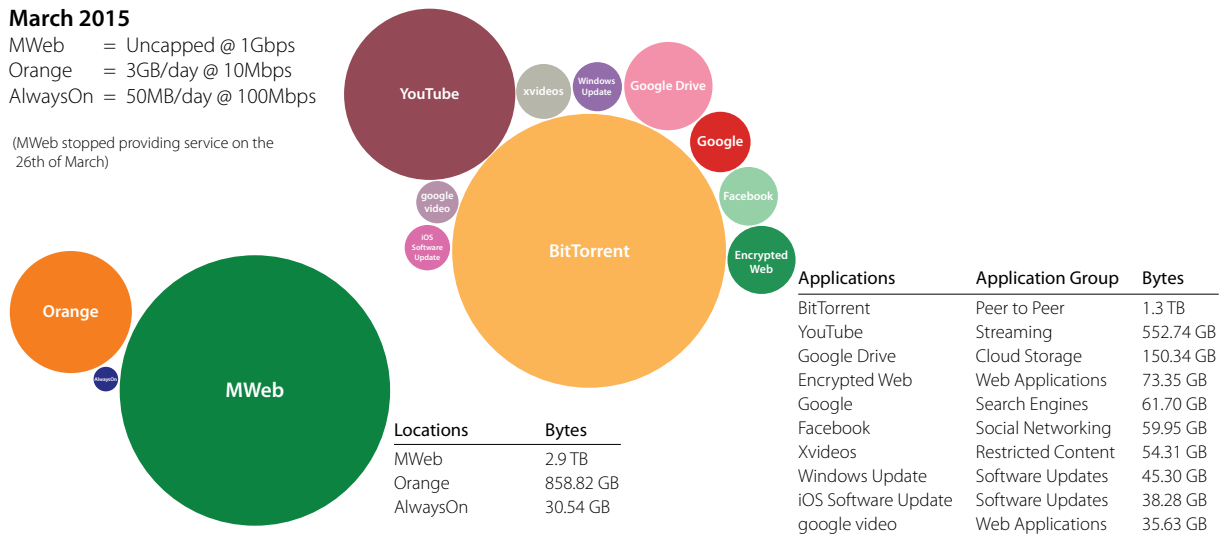


Figure 10: CoCT use for January 2015

Source: City of Cape Town, 2015.

April 2015

MWeb = No Internet Service (Splash page informing client of service stoppage)

Orange = 3GB/day @ 10Mbps

AlwaysOn = 50MB/day @ 100Mbps

(Notice increase in Orange Data usage without MWeb and notice decrease of BitTorrent)

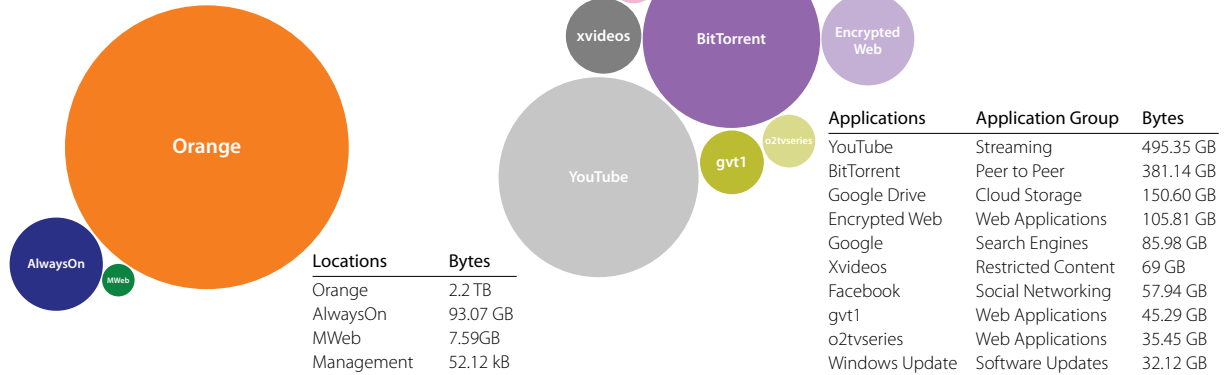


Figure 11: CoCT use for January 2015

Source: City of Cape Town, 2015.

June 2015

MWeb = Service Removed

Orange = 500MB/day @ 10Mbps

AlwaysOn = 250MB/day @ 100Mbps

AlwaysOn increased Cap from 50 MB per Day to 250 MB per Day @ the beginning of June!
(Notice decrease in BitTorrent)

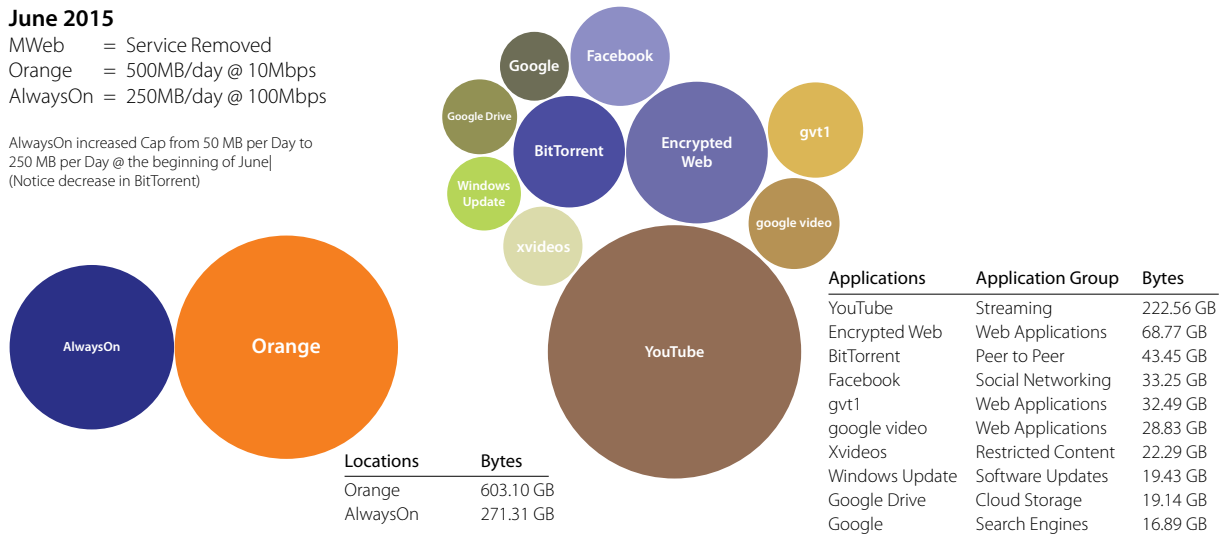


Figure 12: CoCT use for January 2015

Source: City of Cape Town, 2015.

Figure 9 shows similar results for February, with just a slight decrease in data consumption given that it is a shorter month, while Orange more than doubled its use.

In March, the trends continued, as shown in Figure 10. Use increased, Orange increased use relative to MWEB, and the use by application remained similar.

April was significant because by late March MWEB had ceased to operate, resulting in Orange gaining dominance, as shown in Figure 11. MWEB had provided both uncapped data and a fast link (1Gbps). Orange also provided a large daily free bundle (3GB) but users had to share access via a 10Mbps link. Overall data consumption dropped, driven largely by the drop in BitTorrent traffic below that of YouTube. Users seemed to BitTorrent less on capped services.

Figure 12, the final graphic provided by the CoCT, for June, shows the further impact of Orange reducing its daily allowance to 500MB per day, and AlwaysOn increasing their allowance to R250MB per day. Most of the top use applications are video related, with BitTorrent falling further in use. Facebook and Google Search remain on the list.

Further detail provided by the CoCT is that at the end of the study, customers were consuming over 1 000 GB per week, of which 27% was used on YouTube. As the above analysis shows, Facebook is the most popular social media application, although WhatsApp is the most utilised application. Cloud storage was popular, with Google Drive being the only service to feature here. The high use of Google Drive may be at

least partly due to the feature offered by the Android operating system on smartphones, which supports auto-archiving of photographs and WhatsApp media. Software updates consumed significant bandwidth, with Microsoft updates taking up the most data. This implies there was a reasonable proportion of PC users relative to smartphone users; smartphone users would have required Android and Apple (IOS) updates.

The number of unique users was not provided (and the CoCT reports this information was not captured). The number of sessions was captured, however, and stood at 290 438 for the week ending 30 September 2015.

The CoCT reported in November 2015¹¹¹ that the POC was complete. Based on the evaluation, the CoCT had decided not to offer Wi-Fi as a residential access technology, but to rather provide public Wi-Fi zones.

According to Naidoo, these zones will be located “primarily at public-facing City buildings and facilities, such as clinics, libraries, administration buildings, cash halls, motor vehicle registration centres, IRT bus stations and the Civic Centre.”¹¹² These buildings already have power and connectivity (or plans for connectivity). The CoCT intends to continue with its open access Wi-Fi model, which it regards as viable and of commercial interest to ISPs. (Following this model, the CoCT operates and maintains the radio access network and the backhaul to which multiple ISPs can connect and thereby offer wireless internet-based services.)

¹¹¹ Meeting with CoCT officials, 27 November [2015], Durbanville offices of the City of Cape Town.

¹¹² Naidoo, R. *et al.* (Undated). “Case study: Public Internet access using Wi-Fi. Results of a Proof of Concept project carried out in Khayelitsha and Mitchells Plain”. City of Cape Town.

With a large tender expected to be awarded in the course of 2016, the city is increasing its Wi-Fi footprint. Alfreds¹¹³ quotes André Stelzner, chief information officer for Cape Town as saying, “Cape Town has about 170 Wi-Fi hotspots and plans to construct another 120 by the end of the year” (2015). Alfreds also cites MEC Alan Winde as saying there would be at least one Wi-Fi hotspot in every ward in Cape Town within three years. Commercial investments offer free Wi-Fi at popular commercial centres, such as the Waterfront area and Camps Bay beach and restaurant area.

The CoCT included its own internal assessment of the project – essentially the findings from the POC.¹¹⁴ The first finding was that Wi-Fi is not suitable as a residential access technology (within the particular setting). One of the main reasons for this is that the house building materials include iron (galvanised iron, or “zinc” sheets). Therefore the creation of access zones around public buildings was recommended.

Customer use (as shown in the project description) was high from the outset, and grew to roughly a terabyte per week. Information on customer experience, as well as the potential to offer paid services, although researched by at least one service provider, was not available. The actual project costs were not made available for this report, although various findings on costs were shared.

CoCT had used a Wi-Fi vendor, Extreme Networks, which supplied relatively expensive APs and concluded that the premium paid was “fully justified in terms of performance, reliability and remote management capability”.¹¹⁵ One feature regarded as important was network management capability (since the city is managing a single network with multiple providers). Another desired capability is analytics, which allows the CoCT to analyse user behaviour. To add to this, the CoCT concluded that standardisation of equipment, particularly the AP hardware, was desirable in terms of network management.

The cost of extending the CoCT fibre network to additional buildings was high. The city considered this expense ‘justified’ in terms of the objectives of connecting under-served areas. CoCT also extended ISP service from a central point to the Wi-Fi APs at a cost that it considered small, although “not insignificant”, in the context of a large-scale deployment.

In looking at the costs incurred by the service providers themselves, the review concluded that the cost of providing the service was significant for Orange (which created a service specifically for the project) whereas the cost for AlwaysOn was “marginal” (since it already had the systems to manage Wi-Fi access as well as bulk internet capacity). This last conclusion is important when considering the role of commercial investment in FPW.

¹¹³ Alfreds, D. (2015). “Cape Town’s free Wi-Fi plan inches forward”. 16 October. (Available at: <http://www.fin24.com/Tech/News/Cape-Towns-free-Wi-Fi-plan-inches-forward-20151016>) [18 November, 2015]

¹¹⁴ Naidoo, R. *et al.* (Undated). “Case study: Public Internet access using Wi-Fi. Results of a Proof of Concept project carried out in Khayelitsha and Mitchells Plain”. City of Cape Town. Undated. Slides 17ff.

¹¹⁵ *Ibid.* Slide 21

In summary, the CoCT felt that it had a workable model (providing open access infrastructure and having service providers tender to offer Internet via the open access Wi-Fi), hence its decision to deploy further Wi-Fi zones.

CoCT believes that, due to the open access model, it is a neutral player, and does not compete with the private sector. The report does acknowledge, however, that the signal from its own Wi-Fi network would interfere with wireless communication from private providers (since Wi-Fi operates in licence-exempt spectrum) and that the issue of interference “cannot be resolved”.¹¹⁶

In looking at the daily bundles, the CoCT has been able to observe both service provider and user behaviour under differing situations. The first observation is that when multiple service providers operate, users are able to consume free bundles consecutively, effectively receiving multiple allowances. The second observation was that service providers competed for customers by increasing bundle sizes. The (unintended) consequence of this was threefold: increasing demand on the city’s network (requiring capital expenditure to mitigate), impacting on customer experience and reducing profitability for the service providers. Larger allowances were shown to increase peer-to-peer file sharing and watching of pornographic videos, potentially enabling a small proportion of users to have a negative impact on the experience of all users. CoCT saw this as an unwanted trend, since the sustainability of the project depends on lower costs and profitability for service providers.

They, therefore, asked service providers to limit the daily allowance. They observed that after this step, the number of users increased (in their understanding, the service became more inclusive). In the case of Orange, the number of sessions per week increased from 81 476 (under a 500MB per day allowance) to 97 438 (under a 100MB per day allowance). Furthermore, the data use attributed to BitTorrent and pornographic video viewing decreased by over 50%.¹¹⁷

Recommendations from the POC therefore included: that the number of ISPs be limited to three; that the cap be limited; that file-sharing or x-rated content be restricted; and that ISPs be allowed to draw income by advertising or micropayments. In addition, CoCT felt that if they had access to more detailed analytics from ISPs, including fields such as geography and location type (e.g. library or clinic), they could provide a more targeted service.

PROVINCE OF KWAZULU-NATAL

Projects in this province and its cities are not advanced or substantive and the following background and status description is included to complete the national picture and learn from a key failing.

The province of KwaZulu-Natal (KZN) includes one of South Africa’s most populous cities of eThekweni (Durban), which is also a major tourist and port city. KZN lags behind Gauteng and the Western Cape considerably in terms of Wi-Fi access provision but has started addressing this.

¹¹⁶ Naidoo, R. *et al.* (Undated). “Case study: Public Internet access using Wi-Fi. Results of a Proof of Concept project carried out in Khayelitsha and Mitchells Plain”. City of Cape Town.

¹¹⁷ *Ibid.* Slides 28–30

At this stage, the relevant department (DEDAT – the KZN Department of Economic Development and Tourism) believes that free Wi-Fi services can be a “marketing ploy to attract consumers and onlookers to spend on products, services and activities [and play] a vital role by contributing to areas prioritised for social upliftment and poverty eradication” and “to attract investment, accelerate economic development, market key tourist zones and contribute to an improved quality of life”. To this end DEDAT is formulating its plans and identifying “strategic sites/areas/zones for Wi-Fi deployment, which will promote economic development, tourism and social development”.¹¹⁸

Municipality of eThekweni (Durban)

The city was one of the first in South Africa to deploy fibre connectivity as part of its Smart City initiative. As far back as 2008, the fibre network known as “MetroConnect”, commenced connecting public buildings and selling wholesale capacity to ISPs.¹¹⁹ At the time, plans were in place to provide FPW in tourist areas ahead of the 2010 Soccer World Cup.

Since then, eThekweni has maintained a rather low profile in terms of FPW. The most publicised projects were actually private initiatives – those being a large free zone along the restaurant-lined section of Florida Road (now scaled down) and a private initiative in the

area of Mhlanga (where tourists are attracted to the beaches). The city itself has provided Wi-Fi at most of its libraries, having connected 62 out of 91 by April 2014¹²⁰ and, according to President Zuma, having connected 75 (out of 80) by July 2015.¹²¹ Connectivity requires a free voucher provided by the librarian and lasts for one hour. On expiry, one can obtain another voucher from the librarian (with each voucher requiring a laborious written entry into a register).¹²²

Besides the onerous access to Wi-Fi in libraries, the slowdown in progress at eThekweni may be linked to management issues related to the fibre deployment, which are mentioned in the media, although the city fibre project was not specifically researched for this report.

As stated in the introduction to this province, KZN and eThekweni’s projects are not sufficiently advanced or focused on digital inclusivity to study further, but the old public access through public libraries approach is clearly not going to compete effectively with limited on-demand access models such as those being rollout in other provinces currently.

PROVINCE OF EASTERN CAPE

There is no co-ordinated Wi-Fi deployment in the Eastern Cape province. Project Isizwe rolled out a few APs at two educational colleges, which were more for educational than public use.

¹¹⁸ Province of KwaZulu-Natal. Bid tender document Q15 EDTEA 15/16. Terms of Reference Section.

¹¹⁹ Murray, T. (2010). “eThekweni MetroConnect: Broadband for the community”. Case study for Wits Business School.

¹²⁰ eThekweni Facebook page posting: <https://www.facebook.com/eThekweniM/posts/734705093246274>

¹²¹ Oral reply by President Zuma in Parliament, 19 November, 2015.

¹²² Personal experience by the author at the Windermere library, in July, 2015.

The provincial capital, Nelson Mandela Bay (Port Elizabeth) metro has signed an agreement with the Swiss Government which involves provision of free Wi-Fi on the back of a 40m high mast (energy-efficient) lighting project. The project is being piloted in Walmer Township, with one mast currently operational, before decisions are made about more extensive rollout.^{123, 124}

Project Isizwe has also been working for a few months with Nelson Mandela Bay regarding replication of its Tshwane Project¹²⁵, provided that funding can be found by the city.¹²⁶

The built environment plan for the second largest economic area, the District of Buffalo City (formerly East London, Bisho and King William's Town) indicates no specific intention to develop ICT, broadband or Wi-Fi.¹²⁷

PROJECTS IN THE REMAINING PROVINCES

In Northwest Province, Kenneth Kaunda District Municipality (Klerksdorp and surrounds) has announced a budget allocation of R10m¹²⁸ to roll out Wi-Fi within its district, over a three-year period. This district is one of the eight mentioned by President

Zuma for priority deployment of broadband in 2015. The start date has yet to be announced. The Wi-Fi is said to be providing 500MB caps per month, with unlimited access to certain educational sites.

Another district mentioned for priority deployment is Pixley Ka Seme District municipality in the Northern Cape. Currently this province has no announced Wi-Fi plans.

Free State Province has not announced plans, although since the provincial ICT summit in June 2015, Project Isizwe has begun engaging Mangaung (Bloemfontein), the provincial capital.

Limpopo Province has no announced plans, although national government is driving a project to build a fibre-based network (along the lines of other provincial fibre networks) across the province, as a public-private partnership. No doubt this project will include a FPW subcomponent. Project Isizwe has announced a privately-funded project in Limpopo, which is discussed under the "Free Basics" initiative (See Wi-Fi as a basic service and as a free basic service).

There are no significant implementations underway in Mpumalanga.

¹²³ Pillay, D. (2015). "Free Wi-Fi for Walmer Township". The Herald Online. (Available at: <http://www.heraldive.co.za/free-wi-fi-walmer-township>) [5 December, 2015]

¹²⁴ Bryner, A. (2015). "A short trip with federal Councillor Doris Leuthard to South Africa". 13 Feb. (Available at: <http://www.eawag.ch/en/news-agenda/news-portal/news-detail/news/eine-kurze-suedafrikareise-mit-bundesraetin-doris-leuthard>) [5 December 2015]

¹²⁵ Pillay, D. (2015). "Bay set to have free WiFi by 2018". The Herald Online. 10 Oct. (Available at: <http://www.heraldive.co.za/bay-set-free-wifi-2018/>) [5 December 2015]

¹²⁶ Tandwa, L. (2015). "Mayor fast-tracks free Wi-Fi for metro". News24. 16 September. (Available at: <http://www.news24.com/SouthAfrica/Local/PE-Express/Mayor-fast-tracks-free-wi-fi-for-metro-20150914-2>) [23 October 2015]

¹²⁷ Buffalo City. (2015). "Buffalo City Metropolitan Municipality Built Environment Performance Plan 2015/2016". August. (Available at: <http://textlab.io/doc/17594204/buf-buffalo-city-draft-bepp-2015-16>)

¹²⁸ ITWeb. (2015). "SA Connect: North-West allocates R10m for WiFi". 17 July. (Available at: http://www.itweb.co.za/index.php?option=com_content&view=article&id=144766:SA-Connect-North-West-allocates-R10m-for-WiFi) [17 July 2015]

COMPARISON OF FPW BUSINESS MODELS

The previous section of this report included a detailed national scan, describing at both the provincial and city levels projects that are either planned, in deployment or in play, and identifying learnings that emerge from specific projects. Projects were briefly reviewed on their own merits.

This section will provide *common findings* and a *comparative view* between projects.

The first finding should be of concern to policymakers: South Africa has nine provinces, only one of which (Western Cape) is actively deploying public Wi-Fi. Western Cape is the second wealthiest province. The four largest and wealthiest cities – Johannesburg, Tshwane, Ekurhuleni and Cape Town – all have projects underway. The first three of these are in Gauteng (the wealthiest province) and the fourth in Western Cape. Of these, only Tshwane has demonstrated significant deployment of public Wi-Fi. The capital cities of the other seven provinces, the secondary cities and the commercial or industrial districts within these provinces have no projects or minimal deployments, even though (as documented in the previous section of this report) there is active interest at all government tiers (from local to national).

Therefore, using a core-periphery spatial metaphor, the current implementations will, while bringing connectivity to many, also amplify the existing digital divide. If South Africa wants to take

advantage of public Wi-Fi in order to make an impact on its connectivity challenges, much work needs to be done. Policies aimed at reducing the digital divide will need to focus even more sharply on the seven provinces and their cities, not to mention smaller towns and rural areas, where local authorities can least afford to deploy infrastructure, have the least planning and execution capacity, and the most service delivery issues.

The much-delayed tender for the connection of clinics and schools in under-served districts put out by SITA in September 2016 will go some way to alleviating the problem. This tender has a public Wi-Fi component in it, as required by SA Connect, and should bring FPW online within the next year in many areas that currently have very limited connectivity. However, many more will remain unconnected.

In the balance of this section we will compare the projects mentioned above (the provincial initiative of the Western Cape, and the municipal projects of Johannesburg, Tshwane, Ekurhuleni and Cape Town). Of these projects, the most advanced are those of Tshwane and Neotel in partnership with the Western Cape. Furthermore, these two projects employ different approaches, which enable them to be contrasted. They will, therefore, be the main focus of review within this report. However, frequent reference will be made to the top five projects (thus, also including CoCT,

Johannesburg and Ekurhuleni) or other projects, where themes are common across multiple projects.

The headings to follow indicate the criteria around which the projects are compared.

Government building categories

The five authorities all have active projects to connect public sector buildings via a (predominantly) fibre optic network. Public buildings appear to be ideal sites for public Wi-Fi distribution, as there is a relatively marginal operational cost to providing public Wi-Fi. The costly operational items – a secure location with an electricity supply – are already provided for, and public attendance at these sites is guaranteed, with daily attendance generally recorded. Public buildings with existing fibre connectivity provide low-cost backhaul for Wi-Fi, or fibre/Wi-Fi deployment can be planned in tandem. Wi-Fi coverage is provided both within the facility and outside the perimeter (values of 100m to 200m radius were mentioned, 150m being a more likely practical estimate). SA Connect, South Africa's broadband policy, targets 50% of all public buildings to be connected by 2016, giving specific mention to schools and clinics.

The most common category of public building being connected is the educational institution. This makes sense because most government buildings are, in fact, schools. In addition, connectivity is essential for modern learning and many schools are deploying tablets for this reason. Better-resourced schools

have procured their own connectivity. SA Connect incorporates specific targets for school connectivity. Schools and higher education institutions are, therefore, crucial to any strategy.

Tshwane Free Wi-Fi strongly favours educational institutions, which by July 2015 constituted 80% of its hotspots. The demographics of Tshwane users (Figure 2 to Figure 6) show them to be young, typically under 24 years old. The Tshwane beneficiaries video-interviewed for the Tshwane Free Wi-Fi website almost all refer to research and assignments as the main benefits of free Wi-Fi. Much of Isizwe's success derives from this bias – outside Tshwane their projects are also school based and include eight schools in the Western Cape. Project Isizwe's success indicates that a focus on educational institutions can be a significant opportunity, with institutes of higher education, venues where students do their assignments after school, and secondary school buildings being venues of choice for Wi-Fi deployment. Students make willing users of the smartphone, schools have to be connected in any event (as government policy) and students need to be afforded the opportunities that ICT provides. Provincial-level projects to connect schools (such as the projects to connect all schools in Gauteng and the Western Cape) would result in more equitable connectivity across the urban/rural divide than city-driven projects.

In terms of project comparison, if one strips out the educational venues, Tshwane Free Wi-Fi appears to be dramatically less successful (although by no

means unsuccessful) and more easily compared with the other projects. That said, the Western Cape project has selected educational institutions (mainly schools) for 41% of its Neotel project venues.

Another building type favoured for digital inclusion is the library. As mentioned in the project descriptions, libraries formed over half the connections in Johannesburg, are top priority in Ekurhuleni's priority list, are prioritised for connection in eThekweni (and received a mention by the president), are the focus of a separate project in the Western Cape (the Rural Library Project), and also make up 35% of the Neotel Wi-Fi list. Project Isizwe has connected 44 libraries as reported by the Free Tshwane Wi-Fi project. The user profile and impact of these installations is not clear, beyond providing a venue for learners to do homework in the afternoons, and research on this would be useful.

As mentioned in the introduction, the US is particularly committed to using libraries as a mechanism for digital inclusion, with almost 100% offering both PC workstations and free Wi-Fi.¹²⁹ However, it is key that the librarians be trained and ready to assist users, for example with printing resumes or seeking employment. And, as with education, a provincial impetus is required to promote equity and reduce the urban/rural divide within the province. The Western Cape is taking this approach.

The third most common target buildings are health institutions (hospitals and clinics). In Ekurhuleni they are prioritised second to libraries for deployment (and

form 15% of connected buildings in their first phase). Ekurhuleni says they have plans to provide health-related content and apps for attendees. In Johannesburg, clinics make up 16% of connected buildings, and in the Western Cape (Neotel project), 18% are clinics. These ratios are comparable. In Tshwane, only 4.5% of buildings connected (but 24% of non-educational buildings) are health facilities. Providing health content and targeting consumers of health content are broader planning issues than providing Wi-Fi at clinics. Health content should target all age groups, healthy or sick, and can complement or be in lieu of clinic attendance. Tshwane's portal provides excellent health content, highly relevant to the issues of its constituency and including health videos, which a reader with a low literacy level can consume and which are not included in the daily cap.

Commuter sites are probably the most useful of all venues, providing connectivity for the wider public on a regular basis, while people continue with their normal social and economic activities. Many countries provide free Wi-Fi on public transport (as mentioned in the Introduction) including Australia, Korea, Israel and France. Bus stops and buses were targeted in Tshwane. In Cape Town, bus stops were connected by CoCT and the large taxi ranks by Project Isizwe.

Museums and tourist or heritage venues, included in Tshwane's coverage list, are often the first to be covered in developed countries, to attract tourists. In the Introduction to this report, mention was made of the Australian experience, where public Wi-Fi was

¹²⁹ Bertot, I. *et al.* (2015). "2014 digital inclusion survey: Survey findings and results". Information Policy and Access Centre, University of Maryland. October.

introduced to provide supportive information on tourist and heritage sites being visited. Open spaces (parks or open areas in city centres) were included in the coverage list for Cape Town, Johannesburg, Ekurhuleni and Tshwane. These spaces, in South Africa, can be observed to host a wide cross-section of South Africans during the day and during lunch hour.

Based on this range of venues mentioned, it may be useful to refer to an Australian study¹³⁰ that suggests benefits of free public Wi-Fi that are additional to the usual economic list, including “enriching community life; enhancing public safety; providing marketing and communications portals; servicing city employees and sensors; and, most prominently, enhancing local economies by attracting more visitors ... [enhancing] public spaces by adding to their vibrancy and atmosphere” and “a valuable digital resource for different mobile users, including out-of-office workers and travellers”.¹³¹

The study further argues¹³² that open public spaces play a role in stimulating diverse interactions, with social, cultural (expression, interaction identity), commercial and political elements. However, as Daily Maverick columnist Judith February complains, “South African cities, for an array of reasons to do with the past and present have failed to grasp quite how fundamental cities and their development are in creating those spaces

for interaction between ordinary people in a society with such high levels of inequality. Sharing public space is the great leveller, after all”.¹³³ The use of ICT has created an additional dimension to these interactions, in the sense that people communicate electronically while in these spaces, use locating services to position themselves in these spaces, organise themselves (for example in political expression) and obtain data from sensors or video cameras positioned within these spaces. Wi-Fi should reinforce desirable outcomes in terms of those roles, specifically to enhance diverse interaction.

Project Isizwe’s chief information officer, James Devine, tells a good story to support the “sensors or video” aspect of this: He recalls how they noticed live on their security surveillance, a resident setting up his Wi-Fi on his smartphone. As he started to use it, they asked him (from their control centre, via the speaker attached to the Wi-Fi unit), “Are you enjoying Tshwane Free Wi-Fi?” The pleasantly startled man no doubt has memories for time to come.¹³⁴

An example of the political contribution of FPW includes Tshwane’s provision of ad hoc coverage in the Union Building Gardens for public onlookers at the 2014 presidential inauguration. Another is the Company Gardens in Cape Town, which is adjacent to Parliament and has hosted a very diverse range of demonstrations (students, parliamentary catering staff, and a broad

¹³⁰ Lambert, A. *et al.* (2013). “Free Wi-Fi and Public Space The state of Australian public initiatives”. University of Melbourne / Institute for a Broadband-Enabled Society. August 2013.

¹³¹ *Ibid.* Page 1

¹³² *Ibid.* Page 5

¹³³ February, J. (2015). “Sharing public spaces is the best way to bring people together”. Daily Maverick. 14 December 2015

¹³⁴ Project Isizwe website videos.

group of anti-corruption marchers). Free Wi-Fi in the Gardens allows for the social media messages and photographs that are part of the freedom of expression and that contribute to the democratic process.

Theoretically, FPW complements public spaces, allowing for broad communities to interact; provides a sense of identity and belonging for regular inhabitants; furthers culture (“through forms of commerce, individual expression, social interactions, public art, street performances and local events”); and can “lubricate urban flows by providing shelter, relaxation and places to socialise”.¹³⁵ Although these concepts are abstract, and have not been tested in the South African examples, aspects are well demonstrated by Tshwane’s video content services, locally produced in magazine format, which, as mentioned earlier in this report, was soon enjoying a million views per month (see section on Tshwane.) A similar analysis to the above could cover other site types: fire stations, swimming pools, service delivery points, recreation centres and community halls.

Priority then must be given to covering educational facilities (although this should be handled at a provincial level so as to be more equitable), to provide service at libraries (also driven at provincial level, and also ensuring that librarians can assist patrons adequately), at health centres (complemented by health-promoting applications and content) and in open public spaces (as part of a well-thought-out strategy to optimise use of those spaces).

Further, in order to make a significant difference to resident’s lives, coverage must be available at locations that promote sustained, regular use, to the point where access can be integrated into the daily lives of all – be they residents, students, job seekers or business people. Tshwane has the most extensive coverage, with the the mayor recognising that coverage is not completed until every resident can walk to a FPW spot (1km for urban areas, and 5km for rural areas around the city).

The SA Connect policy targets 2.5% of the population’s average income as the cut-off for ICT affordability. This target may be achievable if citizens combine free Wi-Fi data use at selected, easily accessible sites with continuous mobile data coverage for lighter applications. In this respect, coverage along commuter routes is important, such as taxi ranks covered by Isizwe in Cape Town, and bus routes covered in Cape Town and Tshwane. Another positive development is free Wi-Fi provided in taxis by Wi-Taxi, a national joint venture project between Santaco and Telkom. Train stations should enjoy free Wi-Fi (as is the case in Paris) and so should public markets.

Wi-Fi coverage provided solely from public buildings has its limits. A growing broadband economy includes skilled individuals using full-feature PCs for applications, such as software coding, financial analysis and advanced multimedia creation. These desktop workers require a higher level of service than public Wi-Fi is providing. Much of the economic benefit of broadband

¹³⁵ Lambert, A. *et al.* (2013). “Free Wi-Fi and Public Space The state of Australian public initiatives”. University of Melbourne / Institute for a Broadband-Enabled Society. August 2013.

penetration derives from the employment and income from the services of this high-end user group. However, any business that depends on continuous information or real-time applications will find the patchwork of coverage to be business-limiting. This is more the case since muggers find users clustered at Wi-Fi hotspots easy targets.¹³⁶ For the average household to have no coverage at night is also clearly restrictive.

Ekurhuleni, Western Cape and Tshwane have all tried to “beam” Wi-Fi from public buildings, so that at least adjacent households can connect. Although the projects reference different perimeter coverage values, they most likely achieve similar coverage in the 100–150m range, 200m at best. However, when Cape Town attempted to provide coverage from high masts and APs in residential areas, the pilot project found this approach to not be feasible; one reason was that many houses have iron roofing mitigating signal strength.

Funding

All of the projects reviewed, except for Stellenbosch, have built Wi-Fi projects on the back of fibre-based connectivity networks to public buildings; in most cases as integrated projects. For the sake of correctness, in isolated cases, and particularly for more remote sites, high-capacity wireless broadband connections have complemented the basic fibre network, but the principle is the same.

Tshwane Phase 1 appears to have been funded initially on an ad hoc basis, with Phase 2 planned at

the same time as Phase 1, but commitment to Phase 2 was based on its demonstrated success. However, the 2015 official announcement of Phase 3 (a multi-year project) by the mayor indicates financial commitment to at least early 2017 and intentions to consider 2018 funding to achieve coverage goals.

Ekurhuleni is combining fibre connectivity with Wi-Fi connectivity and has pro-actively assigned a significant budget of R120m for 3 000 APs. On the face of it, and judging by progress at the time of the launch announcement, this project is on the back of planning and financial commitment, at least for the current phase.¹³⁷

Western Cape’s commitment is to develop and implement a comprehensive, research-based programme to promote inclusive broadband, rather than to simply offer FPW *per se*. Western Cape went to tender for its connectivity project and then negotiated the 384 sites with the service provider. Considering that this is a multi-billion rand network, with 2 000 schools included, the Wi-Fi budget appears modest. The situation may change once the results of pilots come in and CoCT also expands its projects. Of the projects considered, Western Cape has the benefit of having conducted associated research – pre-project financial modelling, baseline research and ongoing network readiness index research, which may establish causal links between broadband provisioning and economic improvements. Requisite funding commitments may follow results, although such funding is far from

¹³⁶ See, for example: <http://mybroadband.co.za/news/wireless/152505-watch-out-for-criminals-at-public-wi-fi-spots-sa-police.html>

¹³⁷ See above Project section on Ekurhuleni (pp. 35-36).

committed yet. The province is not necessarily seeking to fund projects itself, but to demonstrate the need and costs associated with Wi-Fi provisioning. Research results should assist commercial providers to de-risk their investment decisions. In other words, the pilots may lead to both private sector investment in Wi-Fi and public sector investment in free (or subsidised) Wi-Fi – private delivery of public services.

An example of a hybrid model is where, in the three pilot sites, service providers are encouraged to find alternative funding or investments to extend their pilots. They are also encouraged to offer top-up vouchers for residents to buy when they reach their daily caps. Unfortunately it is too early to get results of the outcomes of these experiments.

In summary, Western Cape’s priority is to catalyse commercial initiatives, but it appears it will fund future public projects if they are shown to support strategic outcomes.

The CoCT has taken a different approach, which it believes has been trialled and is working. It is committed to funding and owning infrastructure. This consists of the backhaul, which is based on its fibre-network rollout (with possible wireless spurs to under-served communities) and the Wi-Fi access hardware. CoCT has resolved to spend more than the minimum on this hardware in order to maintain quality of service and ease of management. In return for providing infrastructure, the city expects up to three private networks to offer the actual broadband

service, on a competitive basis. The city has expressed funding commitment to this approach, with the tender documents for private suppliers issued in 2016.

Johannesburg has chosen to deploy and manage its own network and has expressed funding commitment for its current rollout of 1 000 sites. The funding commitment beyond 2016 is not clear and will most likely depend on the mid-year municipal elections.

Outside of the five projects under study, no financial commitments have been announced by any other authorities. Nelson Mandela Bay’s mayor promised funding for a project of its own, but by the end of 2015 the details had not yet been announced. The funding priorities of most provinces, districts and towns appear to be elsewhere for now, or plans are still in development.

One is mindful of the original Knysna project – which was funded out of ICT savings to be realised – and of the recognition that the town could only sustain future funding of free Wi-Fi based on evident growth in the rates base resulting from the project.

Deployment capability

Provision of Wi-Fi is new territory for the five entities under study, compared to traditional services offered by local authorities (water, electricity and provision of roads) and the underlying technologies are relatively fast moving. It is, therefore, worth considering whether these entities are capable of managing such deployments. All five entities are in the process of

deploying fibre networks, each in a different way. Most projects are behind schedule and still in deployment phase, although conceived 10 years ago or more. The urgency of implementing widespread broadband calls for shorter timeframes.

Knott-Craig Jr, the chairperson of Herotel, has argued that local authorities should outsource deployment and installation of Wi-Fi to experts (such as Project Isizwe/Herotel), since the technical challenges are considerable.¹³⁸ The Tshwane example highlights what can be achieved through such outsourcing. The fact that so many provinces, cities and towns have failed to launch significant Wi-Fi projects (despite signalling intentions) indicates that Knott-Craig's point may be valid.

Tshwane, independently of its fibre network, has indirectly paid Project Isizwe/Herotel to roll out and operate its Wi-Fi network for three years. Deployment has been rapid and a number of innovations have been introduced. Tshwane has benefited from the energy and entrepreneurship of its service providers as they work hard to drive the vision of Wi-Fi connectivity and prove that the project is possible. Were Isizwe to take on another project, it may not benefit from the same zeal and passion, but would certainly gain from the experience of Tshwane.

Ekurhuleni and Western Cape are using commercial service providers to deploy their network and Wi-Fi APs, following a tender process. Ekurhuleni wants to own its network after deployment. This is a large, sophisticated

and industrialised metropolitan (which includes Oliver R Tambo international airport within its boundaries) with a high percentage of urbanisation.

Western Cape, on the other hand, wants Neotel, the second national network operator, to retain ownership so that it carries no Capex-associated risk, but only has Opex commitments. This project is focused on the rural and small-town areas outside of Cape Town. Neotel is paid for connectivity services, which enables the operator to invest in building a network that Neotel can then also use for its own commercial purposes. Neotel is expected to fund the Wi-Fi APs, but will be paid for use over three years. The authority found this approach cost effective and (thus far) conducive to timeous rollout. The province is of the view that there is limited risk in not owning a network that soon ages and becomes obsolete.

Cape Town, being home to two-thirds of the province's residents, opted to own and operate its own wholesale network, built by the existing city service provider, and arranging for multiple Wi-Fi service providers to offer commercial retail services (but including a maximum free daily bundle per user) over its infrastructure. The city's fibre network has purportedly been effective and saved money, and (being a wholesale network) has also generated revenue, although it is not clear whether or not outsourcing could have resulted in an earlier deployment or at lower cost.

Johannesburg's fibre network was to be deployed via a special company (BWired) created in 2009 as a joint

¹³⁸ Knott-Craig Jr, A. (2014). Presentation to Radwin customers, 7 November 2014.

venture between the city and service provider Ericsson SA. The intention was for BWired to deploy fibre on a build-operate-transfer basis over 15 years, however, this project has suffered numerous legal disputes and consequent delays and costs.¹³⁹ Wi-Fi deployment, on the back of network deployment, has suffered as a result.

eThekweni's fibre deployment enjoyed an aggressive start, but has since lost traction, possibly through internal dynamics, and Wi-Fi deployment has similarly suffered as a result.

In summary, deployment capability is more likely to exist within the wealthier provinces and larger municipalities, but even then results have been mixed. The quality of execution of fibre projects seems to be a good precursor to Wi-Fi deployment capability. Project Isizwe is an excellent choice of execution partner for government entities who have funds but need rapid, assured execution.

Quality and extent of service offered

This aspect of the project is considered because a poor service would have very little utility and may be seen as a wasted investment, whereas a very good service may position the project (and hence the users) in a privileged position relative to the average South African who can afford broadband.

In addition, one can compare achievements with the South African policy targets, which call for 50%

of the population to have access at 5Mbps average, by 2016 and 90% by 2020. An additional target for 2020 is that 50% should have access at 100Mbps.

When comparing service to customers who can afford access, there are just over one million South African subscribers to DSL, where (from the author's experience in the industry) most subscribers (on the basic service offering) will be able to achieve downloads of 1.7Mbps, with another cluster of users downloading at around 3.5 to 9Mbps and at a defined maximum upload of only 0.45Mbps. Data speeds available to mobile subscribers vary from 384kbps (in areas where only Edge is available), to 50Mbps (at the limited number of sites where Telkom's LTE-Advanced is in place). Akamai gives South Africa's average download speed in 2015 at 3.7Mbps and average peak download speed as 18.9Mbps.¹⁴⁰ According to Akamai, only 22% of South Africa's Internet users have access above 4Mbps. If one excludes business users, these averages are probably lower. Ookla reported in July 2015 that South Africa's average mobile speed was 10.7Mbps (upload 3.6Mbps).¹⁴¹

Very little end-user experience information is available from the projects reviewed, although information about nominal data speeds has been supplied. Johannesburg committed to offer the "best service" – with 300MB cap per day and 10Mbps download speeds.

¹³⁹ Cernowalow, M. (2015). "ITWeb investigates: Unravelling BWired's network shenanigans". ITWeb. 6 March. (Available at: http://www.itweb.co.za/index.php?option=com_content&view=article&id=141717:ITWeb-investigates-Unravelling-BWired-s-network-shenanigans) [28 December, 2015]

¹⁴⁰ Akamai. (2015). "State of the Internet – Q3 2015 Report". December 2015. Page 38.

¹⁴¹ www.ookla.com

Tshwane Free Wi-Fi reported design download speeds of 7.5Mbps at launch. Mybroadband journalists tested the network soon after launch (in November 2013 at 5pm), before significant user uptake and found the local and international speeds, latency and stability to be very good, with local downloads approaching 7.5Mbps.¹⁴² The network upgraded to 15Mbps mid-2015.

Cape Town's download speeds were not provided by the ISP. The combined bandwidth made available to all subscribers was 1Gbps (initially) via MWEB, and 100Mbps (after March 2015) via Always On.

Western Cape specified, for its Neotel project, 250MB caps (initially) via at least a 2Mbps connection. Given that Neotel will be connecting government buildings at 10Mbps, 100Mbps and 1Gbps within the next year, and that the Wi-Fi project is relatively small in comparison, these speeds should be achieved.

For the NPO pilots, Western Cape specified 1Mbps minimum connection speed. Bundle sizes were not specified. Home of Compassion elected for a 50MB daily cap, whereas Digital Village and Project Isizwe each opted for a 250MB daily cap. These targets are below the SA Connect policy targets for 2016, but in line with the experience of most ADSL paying customers.

The download speeds of the other projects (as far as can be ascertained without undertaking actual use tests) appear to be above minimum policy targets for 2016, above average speeds for most of South Africa's total customer base and close to or above average mobile data speeds. Current speeds

offered will need to be increased to contribute to SA Connect's 2020 targets.

An issue raised in project interviews was quality control. When using multiple service providers to install APs, one needs common installation standards to sign off on projects. Once networks and APs are operational, one needs benchmarks against which to understand network quality. Ultimately, one needs to be able to measure the end-user experience.

In summary, the projects (except for the three small Western Cape pilots) offer good theoretical speeds (better than many more affluent home owners might experience). A limitation of these projects is that they do not monitor user experience.

Daily caps

The daily caps (megabyte allocations per user per day) are also worth reviewing. Table 8 provides the comparison.

Cape Town's early experiment with uncapped service (which was terminated for reasons not related to the project) gave the insight that providing caps affects customer choice of activities. Cape Town also mentioned that allowing retail competition leads to bigger caps (which impact negatively on their wholesale network) and therefore the city will explicitly limit cap allocations.

The doubling by Tshwane of its cap may be partly ascribed to rivalry between the cities (which is known to exist), and increased understanding by Isizwe of

¹⁴² See web reference: <http://mybroadband.co.za/news/wireless/92581-free-wi-fi-in-tshwane-tested-impressive-results.html> [4 November 2015]

its cost drivers. Fewer than half the daily sessions are capped, suggesting that customers learn to work within these limits, however this may change. Video services consume the most data. The Cape Town analysis indicated that Youtube accounts for 70% of data use. Tshwane’s local video content (which is not metered), recorded over one million downloads in one month. In 2015, DSTV launched its new video-on-demand (VOD) service (Showmax) at only R99 per month, MTN reduced the price of its VOD service and

PCCW offered its service at R79 per month. Large global player, Netflix (which accounts for 37% of all United States residential broadband traffic) is also live in South Africa. More users will no doubt wish to exceed their 250MB daily caps (simply in order to watch a single 45 minute episode of a show).

In summary, the current caps of all projects are similar and (except for that of Home of Compassion) appear adequate for now, although the situation may change as video content drives general demand.

Project	Daily cap	Monthly bundle equivalent (GB)	Additions	Conditions
Western Cape	250	7.5	Government sites are un-metered.	Not specified.
Ekurhuleni	250	7.5	Not specified.	Not specified.
Johannesburg	300	9.0	Not specified.	Not specified.
Tshwane – Phases 1 and 2	250	7.5	Numerous health, information, education and local sites are un-metered.	Pornography sites and BitTorrent are forbidden. Many other Internet ports not opened for use.
Tshwane – Phase 3	500	15.0		
CoCT – January to March (MWEB)	Uncapped	Uncapped	N/A	No filtering.
Cape Town – March (Orange)	500	15.0	None	No filtering.

Table 8: Comparison of data bundles by project

Source: Author’s notes.

Content filters

Aside from capping daily use, projects have taken different approaches to filtering what users can access. Whereas the customers of commercial ISPs are able to engage their service providers and change providers if unhappy; there was no evidence found that customers of the projects under review had developed a collective voice to question the policies of providers.

The South African Internet Service Providers' Association (ISPA) has long dealt with issues of censorship, privacy and freedom. Their 180+ members must adhere to their Code of Conduct,¹⁴³ which is revised from time to time, informed by both international best practice and local regulation. The Code of Conduct respects the right of customers to privacy and confidentiality. Members are expected to uphold legal behaviour through various means (such as the terms and conditions of use contract, and compliance with legal requests for information) but members stop short of actively monitoring or restricting customers' content.

ISPs do not (in general) block BitTorrent. BitTorrent is largely used for download of illegal video content, but also has legitimate uses, such as the rapid distribution of new software releases. ISPs in South Africa typically shape, throttle or de-prioritise torrent traffic (rather than blocking it outright). They argue that torrent downloads tend to hog bandwidth and impact the user experience of other customers. Savvy customers in turn choose ISPs whose policies they support.

Tshwane's service is filtered and also limited. Pornography is blocked and BitTorrent content of any type is filtered. A number of other service categories (other than web browsing, VoIP and email) are blocked by default. CoCT, on the other hand (or, rather, the service providers deployed by CoCT), applies no restrictions to content. Cape Town use analysis shows that both pornography and BitTorrent account for significant data use.

According to ISPA benchmarks, the filtering practice authorised by Tshwane (blocking content from 'undesirable' sources on the Internet) would not be acceptable in terms of current self-regulation rules. A few ISPA members might consider the practice patronising, other members might see it as an infringement on the rights of users as adults and yet others as an invasion of privacy. Tshwane's policy of blocking BitTorrent traffic is expeditious but not best practice when compared to a traditional ISP. However, one difficulty in comparing with a standard ISP is that such an ISP is empowered by RICA to maintain customer information (including the identity number of the customer) whereas a public Wi-Fi service is vulnerable to abuse (be it by fraudsters, international terrorists or sexual predators).

Although the public Wi-Fi services are free, users are usually individuals who contribute to the local economy as ratepayers or as tourists (at least spending money locally) and are therefore entitled to contribute to discussions about censorship, filtering,

¹⁴³ ISPA Code of Conduct. (URL: <http://ispa.org.za/code-of-conduct/>) [31 December, 2015]

blocking and confidentiality on the services they consume. As customers become savvier, they may start to question these blocking practices.

Wi-Fi as a basic service and as a free basic service

The five main projects reviewed are very much shaped by their underlying assumptions about the rationale for providing Public Wi-Fi.

Knott Craig Jr was very vocal in pushing for broadband to be accessible via Wi-Fi at all residents and provided in the same way as a city provides basic services (water and electricity) but with the added dimension that the service is free. He refers to the concept of broadband access being considered a human right. Water and electricity services are not free in South Africa and cannot even be described as cheap. Subsidies exist for certain categories of households (e.g. for pensioners), and free services (known as free basic electricity and free basic water) are offered to proven cases of need. Only rural areas, where water is supplied by communal tap, enjoy unmetered access. Knott-Craig is no longer managing Project Isizwe, and the new CEO is open to revenue-generating models.

Based on the above comparison, Tshwane offers free Wi-Fi to the same citizens it charges for other basic services. Although the Tshwane service is capped, the allocation is generous. At 500MB per day (15GB per month) this is more than many affluent residential

ADSL subscribers pay for. Moreover, Tshwane's design download speeds of 15Mbps are above the average speeds of paying ADSL customers. CoCT's approach appears to be more comparable with the provision of roads, where the city owns and maintains the infrastructure, but allows commercial entities to deliver services over that infrastructure. All citizens (as well as visitors to a city) contribute economically by paying rates (or spending at local businesses) and therefore "free" Wi-Fi is not free to citizens, but rather provided as a distributed (infrastructure) service.

Ekurhuleni has adopted the view that Wi-Fi be a basic right, offered predominantly in low-income neighbourhoods. However, the costing suggested by the council implies that Wi-Fi's costs per household will exceed the subsidies they offer for water and electricity and even for an early childcare development grant.

Free Wi-Fi in competition with commercial Internet

There has been minimal public opposition to the introduction of free Wi-Fi in South Africa. This may be because the concept is relatively new to South Africa, and broadband penetration is recognised (by government, the media and the public alike) as being dismally low.

The situation is different in the United States, where free Wi-Fi has been mooted at the municipal level for over 10 years, and has attracted vehement support as well as opposition. Courts in various states have

both opposed (for example, in Virginia, Pennsylvania, Missouri and Texas) and supported (for example, Nebraska) municipal initiatives. Municipal networks are seen as anti-competitive because they use municipal resources to build an entity that competes with the private sector, and they are seen as gaining preferential (often exclusive) access to key sites.

The debate on municipal networks is not within the scope of this report, although the underlying economics of such networks do potentially impact Wi-Fi, which (as has been seen) is often a small but integral part of municipal fibre network deployment.

A feature of Wi-Fi is that it operates via licence-exempt spectrum. A second operator can provision APs adjacent to those of an existing operator and radio interference will limit the effectiveness of both services – an outcome that is not desirable for either operator. The interference can be mitigated if the two providers co-ordinate their network configuration. Another common solution is for a single wholesale provider to provision the physical network, including Wi-Fi APs, in such a way that multiple service providers can seamlessly offer an independent Wi-Fi service to their own customers. This is a particular instance of what is regarded as an “open access” wholesale Wi-Fi network. The essence of this type of open access is that retail operators can compete for customers on the back of the wholesale network. Additional demands of the wholesale provider is equitable terms (no single retail provider is favoured) and transparency (retailers

have equal access to information about the network). Another requirement that is sometimes imposed is that the wholesaler should not play in the retail space. The technical requirement that a network be open access introduces additional functional demands on the APs, which may incur additional cost.

VAST Networks is the only commercial, open access wholesale Wi-Fi provider in South Africa. VAST provides open access networks (for example in shopping centres) although it also provides retail services through AlwaysOn (the two companies both being majority-owned by Internet Solutions). The Tshwane authority has funded Herotel (via Project Isizwe) to become a dominant player in Tshwane (without following a tender process). Even if funding was to cease, Herotel has a substantial competitive advantage going forward. Knott-Craig Junior, CEO of Project Isizwe in 2014–15, was able to build Herotel’s capability and plans before resigning from Isizwe to grow Herotel as its Chairperson from January 2016.

Tshwane’s Wi-Fi network is not open access, a decision which the chief technical officer (CTO) of Isizwe recently attributed to Tshwane Municipality.¹⁴⁴ He says that Project Isizwe has no position on the issue.¹⁴⁵

The CoCT’s network is partially open access in the sense that it allows up to three retail service providers to offer Wi-Fi services on a competitive basis. Cape Town elected to choose more expensive

¹⁴⁴ Devine, J. Q. (2015). Wireless Access Providers Association’s Future Wireless Technology Forum IV Session, Spier Wine Estate’s Conference Centre, 7 September.

¹⁴⁵ Interview with Project Isizwe’s CEO (Khan) and CTO (Devine), Pretoria, 28 January, 2016.

APs, to enable open access as well as to enhance site management. The limitation on the number of retail providers accommodated is in part a technical decision, since each carries an overhead on the performance of the AP.

Ekurhuleni has appointed a service provider to build a network that the city will own going forward, thereby competing with the private sector. Johannesburg also plans to own and control future access. Johannesburg's approach to its fibre network is controversial, with division in council about whether the city should be engaging in business (laying fibre within the city) when multiple private investors have laid fibre along the same routes.

Western Cape has appointed a telco (Neotel) to build and operate a network on their behalf. The province is not investing in the fibre or Wi-Fi build itself, but is only paying for the data used. Neotel, as the winner of this tender, has to take a risk by investing in a network with only one assured customer. It will, however gain a significant advantage over other telecommunications companies in being able to build an extensive, province-wide fibre network significantly funded by its anchor tenant (government), which it can then use for its own commercial advantage, both immediately and after the contract. The same benefit will apply to Wi-Fi. In addition, Neotel will have 384 sites, intentionally scattered across different wards. Neotel may be able to proceed with competitive commercial Wi-Fi offerings but the benefits accrued

will be more from learnings and customer behaviour understanding than the physical network itself.

Another concern is that the existence of a free Wi-Fi network makes it less attractive for private companies to invest in offering broadband services in overlapping areas. Not only would operators be discouraged from investing in prime commercial areas, but in adjacent (outlying) areas as well, as they cannot achieve economies of scale on these outlying areas alone.

Competition to (public sponsored) free Wi-Fi could potentially come from fixed-line broadband, mobile broadband, fixed-wireless broadband, free Wi-Fi (where the Wi-Fi was sponsored by an entity other than government) or paid-for Wi-Fi.

In relation to fixed-line broadband, Telkom is the exclusive, incumbent provider of fixed-line copper broadband and yet is not advancing its service to new suburbs. Providers of fibre are focusing on the more affluent suburbs and are unlikely to be impacted. On the other hand, fibre providers may provide free Wi-Fi in the suburbs they are connecting (an example being the main shopping area and a park in Parkview¹⁴⁶).

In relation to mobile broadband, there is definitely competition wherever free Wi-Fi is offered. Mobile operators have already invested in infrastructure across the major cities and have resources at their disposal to mount legal action if they believe they are threatened. It may be the case that mobile use in areas with free Wi-Fi actually increases as economic

¹⁴⁶ Parkview Residents' Association. 5 November 2014. (Available at: <http://www.parkview.org.za/?q=news/connectparkview>) [15 December, 2015]

activity increases and customers appreciate and gain dependence on the utility of mobile data.

Fixed-wireless operators (WISPs, or wireless Internet service providers) are likely to be prejudiced against sponsored Wi-Fi, because they offer Internet services to SMEs (small and medium enterprises) and to government buildings, including clinics and educational institutions in areas with marginal broadband coverage. Furthermore, they have relied on municipal access for key high sites. Finally, they use Wi-Fi spectrum for their broadband backhaul connections and over time they have learned to cooperate in reducing radio interference between operators. Public free Wi-Fi potentially causes substantial interference to their backhaul connections.

The extent of the impact to WISPs would require further research. The eSchools Network¹⁴⁷, a non-profit organisation aimed at providing connectivity and associated services to schools, did receive an immediate drop-off in demand for Internet connectivity in the Western Cape, simply after the announcement by government that it would connect all schools. On the one hand, schools gain from the improved connectivity that the provincial network affords, but on the other, they could lose out on the crucial educational services that this non-profit provided together with connectivity.

There are many schools yet to be connected in the country, most of them rural. WISPs are responsible

for connecting many schools¹⁴⁸, usually providing discounted services and often with a deep passion to assist. As examples, Bitco (in Johannesburg) and Jireh (in the Free State) sponsor educational institutions. Comtel (in Cape Town) funds SENT, a non-profit offering school connectivity and support.¹⁴⁹ In more remote areas, the school connectivity (although subsidised), should be seen as a contribution to the viability of the WISP business, and should be encouraged by government. Bushguru in Hoedspruit connects multiple schools and a further education and training college, offering online teacher resources and assisting teachers to use the Internet effectively.¹⁵⁰ Belanet offers a free basic connection, which is a community contribution, combined with the opportunity for upselling.

In order to understand how competition could exist with other providers of free Wi-Fi (that is, where the Wi-Fi is sponsored by entities other than government), one needs to appreciate what returns such providers expect. A table indicating common sponsorship models and expected returns was introduced earlier. The CoCT and Western Cape provincial models allow for an element of retail investment, not in the infrastructure, but in the services.

It has been stated that one of the reasons (internationally and in South Africa) that local authorities provide free Wi-Fi is to attract tourists or businesses into their area. For example, 49% of business travellers listed free Wi-Fi as a deciding factor for

¹⁴⁷ eSchools Network Website: www.esn.org.za

¹⁴⁸ The author has interviewed and met with such WISPs over time in Limpopo, Western Cape and Gauteng.

¹⁴⁹ Schools Educational Network Trust Website: www.sent.org.za

¹⁵⁰ See web reference: <http://bushguru.co.za/resources.html>

choosing a hotel in a global survey in 2015. This driver of choice was three times more common than that of the next most common deciding factor, free breakfast, reported by only 14% of travellers.¹⁵¹ Apart from local authorities, restaurants, cafés and hotels use free Wi-Fi to attract business. The same principle applies to larger commercial areas. Airports (departure lounges) and most large shopping centres in South Africa now offer free Wi-Fi. Commercial areas that offer free Wi-Fi include much of the V&A Waterfront Area, Camps Bay Beach area in Cape Town, and the Florida Road Precinct in Durban. These are zones sponsored by commercial interests. Municipal projects may not only inadvertently compete with these projects, but may also waste public funds by investing in services that local businesses were already providing.

However, we were not able to find incidences of such impact, except for a single case of combined effort in the wealthy Johannesburg suburb of Parkview. Here the residents' elected fibre provider will provide free Wi-Fi for the commercial area¹⁵², the City of Johannesburg has connected the library (located in the same commercial area) and Gauteng Province will connect the three public schools (which are within 500m of the same commercial area).

Commercial entities sponsor Wi-Fi to attract business. Advertisers can also sponsor Wi-Fi by providing advertising content on the “splash page” of the captive portal (the Web page that users land on in order to register for free Wi-Fi). Local provider

AlwaysOn, for example, redirects users to a sponsor's page after sign on.¹⁵³ Another technique is to require users to watch advertising to build up use credits. Customers are accustomed to sponsored content from radio and TV stations and websites.

A significant source of value from Wi-Fi derives from analytics – Wi-Fi enables unprecedented levels of user data analytics. Wi-Fi service providers have records of each user (obtained on initial registration), together with that user's associated device. They can record device type and accurate Internet use (times, durations, Internet destinations visited). A very powerful feature of Wi-Fi (relative to traditional cellular) is the accurate information it can provide on user location. Two potential uses for customer information are in personalised form (tracking individuals locally, even nationally), or in aggregate form (tracking population behaviours and trends).

An example of the value of individual tracking is for store retailers, who are already building up sophisticated user profiles based on purchase preferences. They complement their existing information with Wi-Fi-derived information about customer movements within stores (even in competitor stores). Another example of personal tracking is crime surveillance. Police can determine which individuals were present at multiple crime scenes and list them as suspects. A sinister use of the same algorithm is to track activists present at multiple political marches or demonstrations.

¹⁵¹ Survey by Hotels.com. “Free Wi-Fi reigns but wanes as top hotel amenity...”. Press release on May 6, 2015.

¹⁵² See web reference: <http://www.parkview.org.za/?q=news/connectparkview> [15 December 2015]

¹⁵³ User experience at three South African airport departure lounges during 2015.

An example of aggregate tracking in public areas (such as a city park) is to track crowd densities by time of day or day of the week, or on special holidays, and to understand behaviour (numbers walking through, the most common entry and exit points, points of interest where people spend the most time). Aggregate tracking has significant potential to enrich a city's understanding of commuter behaviour, which the city can use to optimise services such as public transport.

Wi-Fi data, combined with analytics offers an opportunity for direct (to the smartphone) and personalised customer engagement not easily offered via other platforms. Analytic data can therefore be sold to sponsor free Wi-Fi, either alone, or as a powerful enrichment to an advertising or "customer engagement" service. In many cases, sharing location information can enhance a value-added service, such as with the Tshwane crime-in-progress reporting app mentioned earlier.

Facebook and Google realise the value of analytic-driven advertising. Facebook, through its Free Basics programme¹⁵⁴ (previously called the Facebook Zero programme)¹⁵⁵ has partnered with mobile operators to offer basic content access (centred around Facebook) for free, and has extended this concept to Wi-Fi – an initiative called Express Wi-Fi, initially piloted in India,

but with Project Isizwe as a local partner.¹⁵⁶ Google has a similar service with selected mobile operators, called the Google Free Zone and Wikipedia has Wikipedia Zero. Naturally, there are concerns that such services threaten the concept of net neutrality¹⁵⁷, and also that the poor are forced into restricted versions of the Internet dominated by companies such as Facebook or Google.¹⁵⁸ These undesirable outcomes should be weighed against South Africa's current situation (where free Wi-Fi services are currently inaccessible to residents in seven out of nine provinces). The dangers of data analytics relate to legality, ethics and public trust. There are laws to protect customer privacy and confidentiality. These place a legal obligation on the entity obtaining the information to protect and manage access to customer information. In South Africa (and many other African countries) laws have been updated recently or are in the process of being updated. There are also ethical considerations for the use of such data. For commercial use, customers should be informed and give consent to the use of their information. The extent to which Wi-Fi data should be available for government surveillance is a political issue. The intention of this report is to highlight the potential use for crime prevention – but also for political surveillance – and to evaluate the current FPW projects in terms of

¹⁵⁴ See web reference: <https://0.freebasics.com>.

¹⁵⁵ See web reference: www.Internet.org.

¹⁵⁶ See web reference: <https://info.Internet.org/en/story/expresswifi/> [3 January, 2015].

¹⁵⁷ Lanerolle, I. (2015). "Data remains an expensive luxury in Africa but free Internet may not be free". 15 September 2015. (Available at: <http://theconversation.com/data-remains-an-expensive-luxury-in-africa-but-free-Internet-may-not-come-free-47488>) [29 November, 2015].

¹⁵⁸ Graham, M. (2015). "Internet for all remains an impossible dream, no matter what Jimmy Wales says". 8 October. (Available at: <http://theconversation.com/Internet-for-all-remains-an-impossible-dream-no-matter-what-jimmy-wales-says-48423>) [29 November, 2015].

privacy and confidentiality. The final, related danger is public trust – customers are largely unaware of the technicalities of Wi-Fi and so are unlikely to be aware of how much personal information is being collected, or can be. However, a public media or social media campaign could change this.

A final free Wi-Fi model worth discussing involves commercial providers offering a free basic service (often as little as 30 minutes free, or 50 megabytes free) with the customer able to continue on a commercial basis using a credit card or via a prepaid, top-up voucher, paying for use per hour or per megabyte). South African Wi-Fi providers (AlwaysOn, Skyrove and Red Button, for example) provide service based on this model. The free element is sponsored by the business operating at the location where the Wi-Fi is provided. Local Wi-Fi providers do not divulge their conversion rate (from free to paid) for this top-up approach, but it is believed to be modest.

The FPW projects can now be reviewed from the point of view of the benefits and dangers of advertising and analytic-based sponsorship. However, that review should include how each project considers the traditional approach of charging for Wi-Fi use.

Customer privacy, confidentiality and information security depends on the quality of the arrangement that the City of Tshwane has, not only with Project Isizwe, but with Herotel (which is the 100% outsourcing agent) and therefore requires access to all customer information to function. Herotel plans to link devices to actual

customer information so that residents whose rates are paid up receive double the data allowance. Tshwane would have to provide private account information to Herotel in order to enable this functionality.

For the CoCT project, each service provider runs a traditional commercial service, as long as the specified daily free allowance is included in the offer. The service provider forms standard and independent relationships with end-customers, as they would any commercial customers. At the moment, the city uses aggregated data analytics, based on its wholesale service, and procured via its third party service provider (Duxbury) to monitor and understand overall uptake of the service, as well as what customers do with the service (information that was made available in this report). Individual service providers collect and maintain their own (retail) data. Unfortunately, because this data is private, it was not possible to obtain from the current service providers the extent to which customers buy vouchers once their free allowances are depleted.

The Western Cape's three pilot projects encouraged service providers to obtain local sponsorships and additional funding (for example, through advertising) and sell top-up vouchers. During the trial, the province requested certain information from each provider, including the top-up rates achieved, but at the time they had difficulty in setting up systems to achieve the required reporting capability. More recently, their systems seem to be improving and they are now offering the correct information. One hopes that

these systems are better at managing privacy and confidentiality than at providing analysis.

Home of Compassion, one of the three trial participants, provides only 50MB free allowance per day, and sells top-ups. At the time of writing, one month's statistics were available, and in trials undertaken in 2015, customers downloaded 708MB of free access, and paid for 149MB, giving a conversion rate of 21%.

It is one thing for local government to acknowledge responsibility for providing broadband and another for that authority to commit resources. Wi-Fi competes for resources aimed at addressing basic services – potable water, housing, health, electricity and education, for example. Urbanisation exacerbates the constraints. Granted, investment in broadband may yield economic returns (which other basic services may not) but those returns will take years to realise.

An alternative source of funds could derive from private sector investment, if returns can be demonstrated for the business and for investors. Initiatives are needed that become catalysts for finding commercial or market-based solutions to the social problems of excluding the poor from access to basic services. Initiatives should, further, create conditions that attract investment in socially-inclusive businesses – what is commonly known as “impact investing”.¹⁵⁹

Wi-Fi is not free – someone is always paying for it. Provision of low-cost (rather than free) broadband services is stated as a vision for South Africa. In particular, SA Connect's vision is for 100% of the

population to have access to broadband at a monthly cost of 2.5% or less of the average household monthly income by 2020. A household income of R3 490 per month would yield a monthly cost of R87. A possible counter-argument is that to achieve SA Connect's target of 50% broadband penetration by 2016 (at 5Mbps), would require extensive FPW coverage. However, the longer-term vision (of reduced-cost Wi-Fi, rather than free) needs to inform Wi-Fi policy.

The Western Cape authority appears to be attempting to use the three pilot projects to find working models to build upon. Experimenting with non-profit organisations for developing for-profit models, has had some success. The act of giving three non-profit organisations grants of R1.2m each in order to find a sustainable model may not be sufficient – a more intentional and sustained search for working models may be required.

Outside of the free Wi-Fi projects under review, there are other initiatives wishing to commercialise Wi-Fi, while focusing on the entry levels of the market. The falling prices of Internet breakout, backhaul and access equipment should be considered against the considerable pent-up demand for broadband, as well as a sense of corporate responsibility to offer more South Africans the opportunity to be connected. This idea is picked up globally. For example, Jimmy Wales, founder of Wikipedia, said in September 2015 that “it is obvious from all trends the net will be available to nearly everyone in 10 years. No contrary evidence.”¹⁶⁰

¹⁵⁹ Koh, H. *et al.* (2012). “From blueprint to scale. The Case for philanthropy in impact investing”. April. (Available at: http://acumen.org/wp-content/uploads/2013/03/From-Blueprint-to-Scale-Case-for-Philanthropy-in-Impact-Investing_Full-report.pdf)

¹⁶⁰ Tweet by Jimmy Wales (@jimmy_wales) on 27 September 2015.

A number of individuals and organisations are open to finding Wi-Fi provisioning models that are commercially sustainable and yet significantly more affordable than current solutions. A few examples are given:

- Telkom has formed an alliance with the Taxi Association, whereby commercial Wi-Fi is offered in taxis, with the first 50MB free. Telkom obviously sees a commercial benefit while thousands of commuters benefit daily.
- RedButton¹⁶¹ is a public Wi-Fi provider in the Western Cape. CEO and owner, Mansoor Mohamed, is investigating a model where communities save costs by hosting their own APs. Mansoor's previous experience, working for the CoCT's broadband project, led him to develop a product called "SharemyNet"¹⁶² to provide paid-for, low-cost Internet access. RedButton Mobile was a finalist in a 2014 Cape Town business competition¹⁶³, sponsored by the city and PricewaterhouseCoopers (PwC).
- Village Telco¹⁶⁴ is a project that relies on residents to extend coverage to each other via a Wi-Fi mesh. The underlying technology is a unit called a Mesh Potato that is based on a

standard AP, loaded with open source software. South African deployments¹⁶⁵ have been in the Bo-Kaap in Cape Town as well as two projects in the rural Eastern Cape – Kranshoek and Mankosi. The houses at Mankosi are rural and scattered, with average income under R390 per month and residents spend up to 22% of their income on communication (a total of R120 000 being spent on mobile voice and data each month). The delivery model being researched by the University of the Western Cape centres on the Mesh Potato and on a local cooperative (Zenzeleni) servicing surrounding communities¹⁶⁶, with the view that there are almost 1 200 such communities in the province alone, and over 7 000 in the country.

- Another Wi-Fi mesh project in Gauteng (for example in Thembisa), Limpopo and Mpumalanga, is operated by e-Mbizo Solutions¹⁶⁷, run by entrepreneur Thabo Malebadi. The project emerged from trials that began in 2010 of a technology to connect educational institutions, using a Wi-Fi mesh network. The trials involved the Department of Science and Technology, together with

¹⁶¹ See web reference: www.redbutton.co.za

¹⁶² See web reference: www.youtube.com/watch?v=3BoZCCiCtM

¹⁶³ See web reference: www.pwc.co.za/en/press-room/vision-awards.html

¹⁶⁴ See web reference: <http://villagetelco.org/>

¹⁶⁵ See web reference: <http://villagetelco.org/deployments/> [18 October, 2015]

¹⁶⁶ Rey-Moreno, C. (2013). "Zenzeleni Networks Ltd building community telcos". 15 July, 2015 (presentation to the WAPA Future Wireless Technology Forum III).

¹⁶⁷ See web reference: <http://embizo.co.za>

the Meraka Institute of the CSIR (within their Broadband 4 All initiative), with European Union funding. This project was not aimed at FPW *per se* (although e-Mbizo offers free Wi-Fi at schools). Delivery is focused on Village Operators, who are trained to create a business by promoting the Wi-Fi service.

- Both Skyrove and Wish (two WISPs) were founded to offer broadband (via Wi-Fi) in apartments. There are still business opportunities to service apartments with students, lower-income residents and high school footfall areas.¹⁶⁸
- Safaricom (a WISP in Potchefstroom) has also provided a public Wi-Fi access service for a few years, including Wi-Fi for private student housing near North West University. In 2012, they had 200 Wi-Fi APs installed and were delivering 1TB per month. By mid-2015, there were 250 Wi-Fi APs installed on which 19TB of data were consumed each month. They run a profitable business (and employ local staff) selling R100 vouchers for 30 days' unlimited use. Customers are on record as having used as much as 250GB on one voucher.¹⁶⁹

The point of itemising these providers is not to confirm that they have viable business models (that would require further research), but to illustrate

that public Wi-Fi provisioning is a vibrant industry that is most likely capable of meeting basic needs, contributing to government targets, building local business and employing local staff, if the appropriate business models are found and encouraged.

Small wireless operators are concerned that Wi-Fi may negatively impact development of these models. Duncan McLeod (a senior telecoms journalist) also cautions against the unintended outcome of certain government investments, saying, "There are hundreds of small wireless players in South Africa itching to provide services, and to do so at prices far lower than anything offered by the big incumbents. This is where South Africa ought to be trying to foster innovation. This is how we'll bridge the digital divide."¹⁷⁰

¹⁶⁸ The author has interviewed wireless providers across South Africa in 2015.

¹⁶⁹ Kruger, J. (2015). "Building a network in Potchefstroom". 15 July Safricom Telecoms. (Presentation to the WAPA Future Wireless Technology Forum III).

¹⁷⁰ McLeod, D. (2015). "The challenge of connecting SA's rural poor". 19 July. (Available at: <http://www.techcentral.co.za/the-challenge-of-connecting-sas-rural-poor/58306/>) [23 December, 2015]

FPW USE IN SOUTH AFRICA: WHAT THE EVIDENCE TELL US

Currently the data and information on public Wi-Fi access and use is sparse. However, this data is of paramount importance because it allows one to design specific strategies of demand-side stimulation and to identify precise points of policy intervention regarding access to public broadband.

During the first phase of the research on public Wi-Fi, Research ICT Africa assessed both the supply-side of public Wi-Fi, and the underlying business models of the initiatives developed across the country. This study marks the second phase of the research, and aims to understand the demand-side of public Wi-Fi focussing on the Western Cape's projects as well as Project Isizwe's in Tshwane.

In order to gauge a Wi-Fi users' perspective, the research seeks to answer the following questions:

- 1) Who are the users of free public Wi-Fi?
- 2) What do people use free public Wi-Fi for?
- 3) When: How frequently do people use free public Wi-Fi? For how long do they use it?
- 4) Where do people use free public Wi-Fi?
- 5) How: What devices do they use at public Wi-Fi hotspots?
- 6) Why do people use public Wi-Fi?

To gauge users' access and use of public Wi-Fi, we apply a hybrid research methodology which includes an online survey and ethnographic research.

A short questionnaire (see Appendix 1) was designed to implement the online survey. Specifically, we sought to obtain the following data:

- the demographics of the user population;
- the purposes of using public Wi-Fi connectivity;
- the preferred public Wi-Fi location;
- the device used to connect to the public Wi-Fi network (laptop, tablet, mobile phone); and
- the reason why people opt for public Wi-Fi use (against other options of connectivity).

The questionnaire was prompted every time a user logged onto the Isizwe public Wi-Fi access point and allowed for single or multiple responses, depending on the question. The survey was administered online over Project Isizwe's public Wi-Fi network and was promoted via social media. The #LoveFreeWiFi hashtag was used on the @RIAnetwork and @ProjectIsizwe twitter accounts as well as the respective Facebook pages to invite public Wi-Fi users to participate in the research.

Neotel conducted the survey independently using the same questionnaire.

A total of 500 respondents participated in the survey on Project Isizwe's network, while 300 answers were collected over Neotel's public Wi-Fi network.

In addition, we conducted ethnographic studies to supplement the quantitative survey data. Ethnographic research methods involve the study of a group of subjects in their environment in order to gain a detailed understanding of the circumstances of the subjects. This kind of research enables the researcher to discover interrelationships, to contextualise behaviour and to describe it in depth. Ethnographic research involves the use of participant observation, which enables the researcher to participate in the daily lives of the subjects under study while making important observations of such things as themes and questions for future visits. Specifically, the aim of the ethnographic study is to understand the reason why people access and use public Wi-Fi as opposed to other means of connectivity.

Ethnographic research was conducted in Cape Town and in the City of Tshwane in the Gauteng province. We covered nine sites in Cape Town including Church Square, Long Street, St. Agnes Primary School in Woodstock, the Isabelo Bench in Adderley Street, the Company Gardens, the Educational Centre in Parow, Tygerberg Hospital, the Government Services Building in Goodwood, and Home of Compassion in Delft. In Tshwane, ethnographic research was conducted in four public Wi-Fi access points: Church Square in central Pretoria, the Tshwane North College, the University of Pretoria's Hatfield campus and the Mamelodi Municipality Offices and Community Centre.

We conducted semi-structured interviews and participant observation of public Wi-Fi users. Participant observation included the capturing of qualitative data in the form of photos, short videos and digital voice recordings. Semi-structured interviews were conducted to capture the perspectives of the subjects under study and understand why they use (or do not use) free public Wi-Fi.

Last but not least, we ran a few broadband performance tests using the MySpeedTest application. MySpeedTest data allow one to assess differences between Wi-Fi and cellular performance in addition to collating data representative of traffic destinations, connection points, as well as connectivity duration and frequency.

Wi-Fi vs. cellular use

A study conducted by a group of researchers in Princeton University and Research ICT Africa (Chen *et al.*, 2016) has provided initial empirical evidence on Wi-Fi versus cellular use in South Africa. While comparing Wi-Fi vs cellular use for the top five most used applications in South Africa and in the United States, Chen *et al.* (2016) found out that South African users seem wary of cellular data use, preferring Wi-Fi connections for almost all of the top five most used applications. (Facebook being the notable exception.) According to the researchers, this may imply that South African users may take more active measures against using cellular data when not

in Wi-Fi coverage. Therefore, it seems that South Africa users are more cognisant of cellular data use. Facebook presents an exception to this observation. Arguably the most prevalent social media application in the United States as well as in South Africa, it displays higher average cellular than Wi-Fi data use for both countries.

Demographics of Wi-Fi users

Our online surveys conducted over the networks of Project Isizwe and Neotel show in April 2016 over Isizwe network and in September 2016 over Neotel network show that 65.3 percent of Tshwane public Wi-Fi users are between 16 and 35 years old, the

majority of them are under the age of 25 and more than a half (57 percent) are male. Similarly, the majority of respondents of the Neotel survey (i.e. 68.7%) are below the age of 16, and 64.9% of all respondents are male.

Across Isizwe network, almost all members of the population under investigation (95 percent) have a qualification, 38.3 percent holding a matric as their highest and approximately one fifth (18.7 percent) holding a university degree. Similarly, 88.6% of Neotel users have some form of qualifications, and the majority of them (32.6%) have a matric. Regarding levels of employment, only 35.6 of Tshwane Wi-Fi users have jobs (either employed or self-employed),

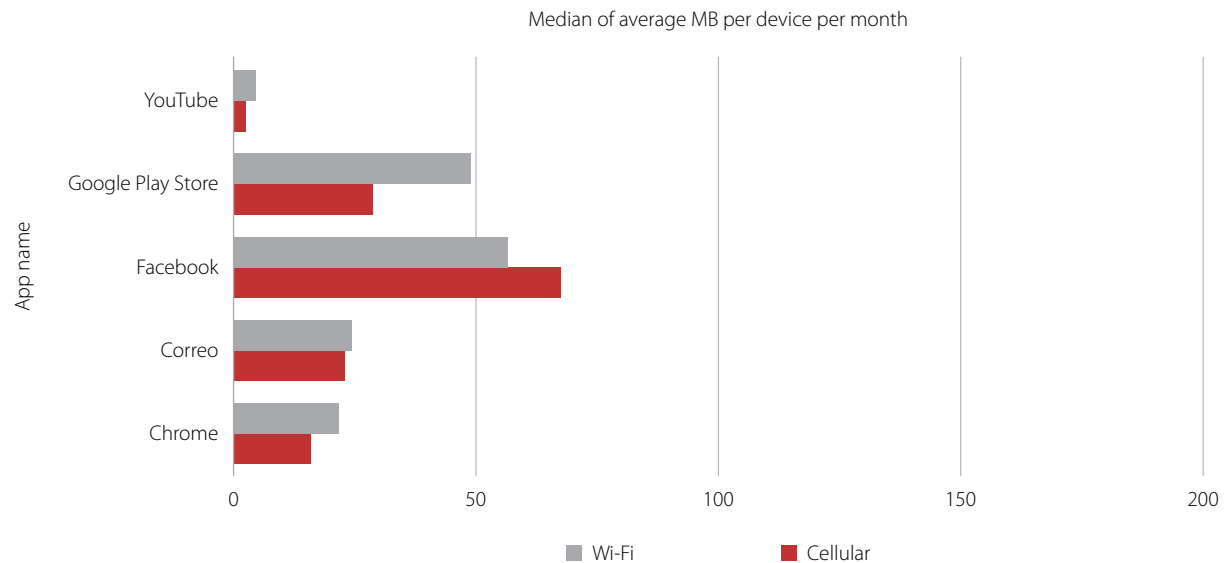


Figure 13: Use breakdown by connection type for top 5 apps in South Africa

Source: Chen *et al*, 2016

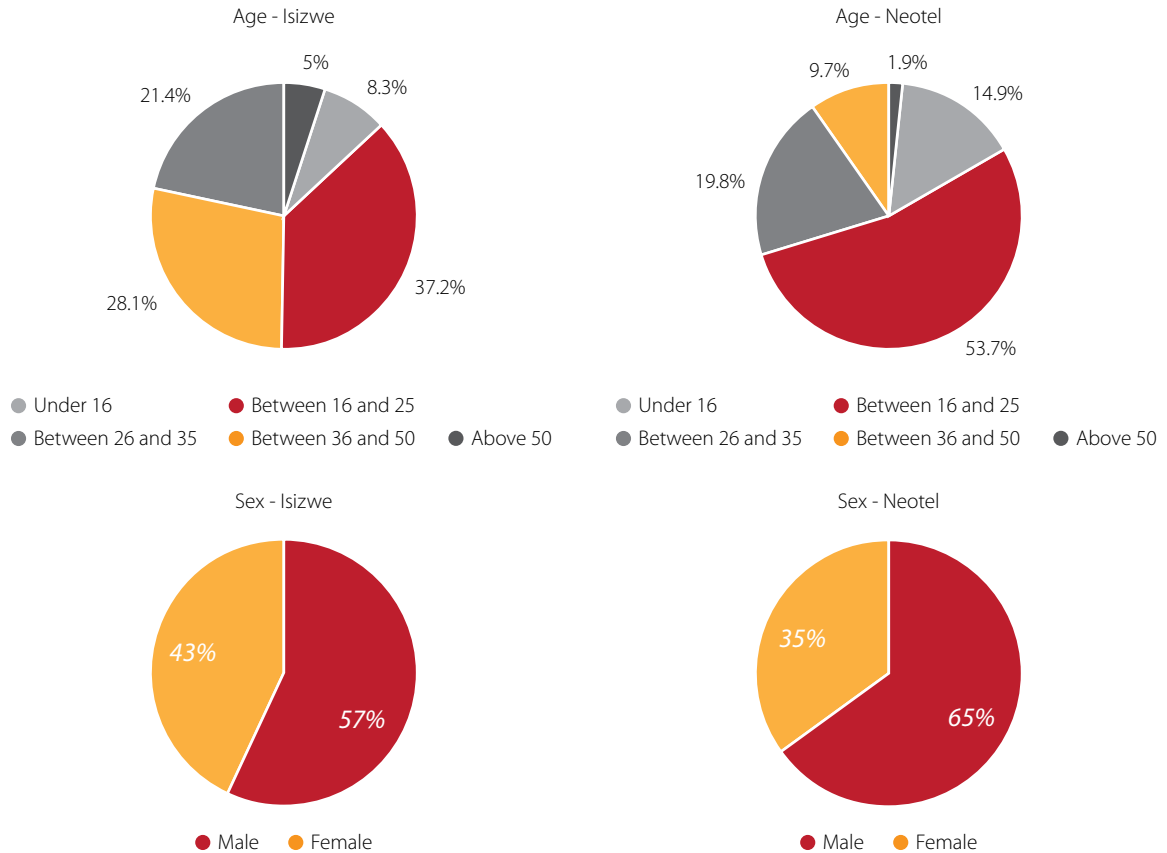


Figure 14: Age and sex of online survey respondents

Source: RIA web surveys, 2016.

while only 29.6 percent of Neotel users have a job. A significant portion of Tshwane Wi-Fi users (21.4%) are unemployed and list no other main activity; whereas students, for example, make up 37.6 percent of the respondent population. In the case of Neotel users, only 5.4 percent are unemployed, and as much

as 63.9 percent are students. This might be due to the fact that most of Neotel's public Wi-Fi hotspots are located in the proximity of schools.

The high number of students using public Wi-Fi is confirmed by a user's comment on public Wi-Fi users in the Company Gardens: according to him,

school children gather every day in the park to use the public Wi-Fi service provided by the City of Cape Town (Interview, 5 April 2016, Church Square Cape Town). A student outside Tshwane North College in Tshwane also noted that Church Square (Tshwane) was a popular free Wi-Fi zone as students would go there to socialise and surf the Internet (Interview, 5 April 2016, Tshwane North College).

Almost one third (32.4 percent) of Tshwane Wi-Fi respondents reveal that they use public Wi-Fi because it is free. Slightly less (29.9 percent) affirm that they use internet at public Wi-Fi hotspots because connecting to broadband is otherwise

expensive. Nearly 38 percent of Neotel users instead indicated that they use public Wi-Fi because internet is expensive otherwise; and one fourth of them (25.3 percent) use the Internet at public Wi-Fi hotspot because it is free. Avoiding mobile data charges is also one of the reasons for using public Wi-Fi expressed by one user of the Isabelo bench in Adderley Street (Interview, 5 April 2016, Adderley Street Cape Town). During an interview in Church square, a public Wi-Fi user said “I definitely spend less money on airtime with all these public Wi-Fi hotspots. This is the best option [to access the internet] instead of buying [cellular] data.” (Interview, 5 April 2016, Church

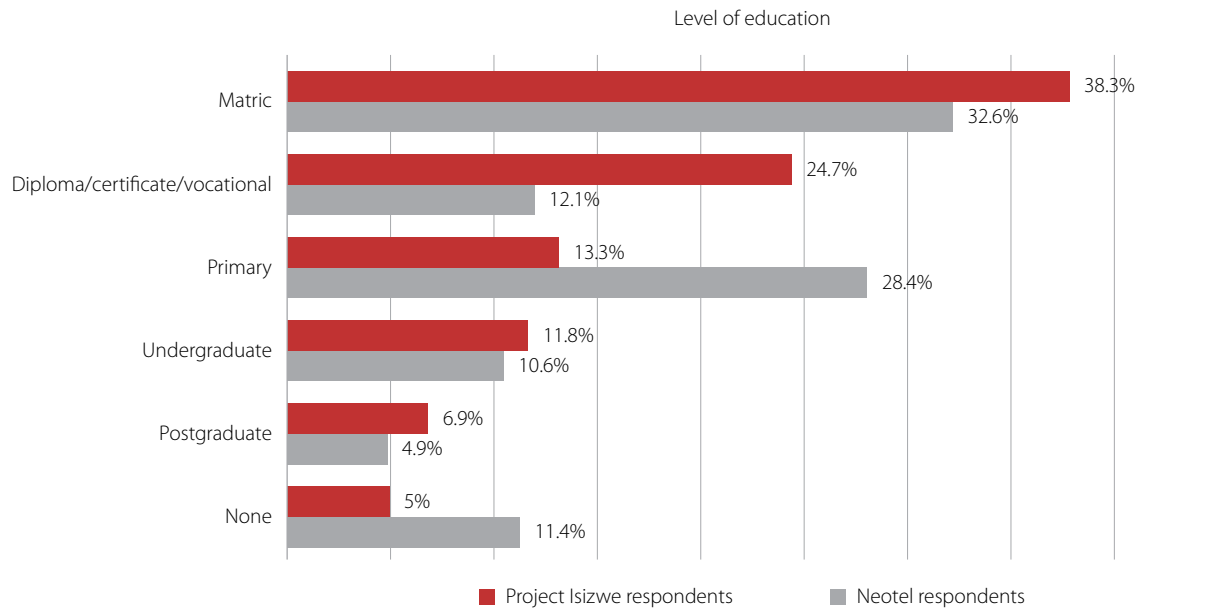


Figure 15: Qualifications and activities of online survey respondents

Source: RIA web surveys, 2016.

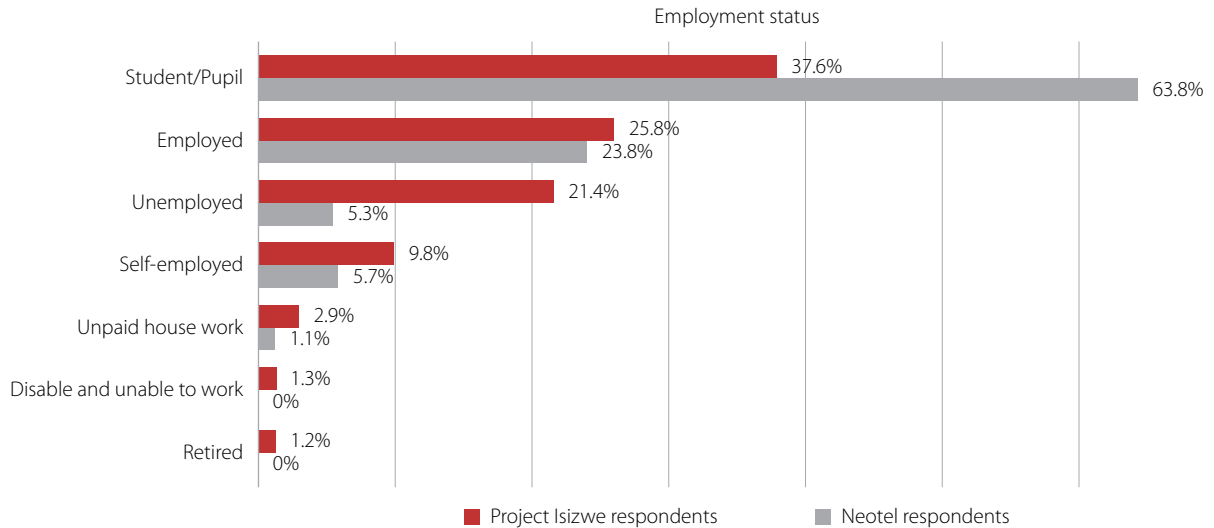


Figure 16: Employment status of online survey respondents

Source: RIA web surveys, 2016.

Square Cape Town) A public Wi-Fi user in Church Square, Tshwane, further noted that “free Wi-Fi saves me data” (Interview, 5 April, Church Square Tshwane). However, free internet and saving money on expensive mobile fees are not the only reasons for using public Wi-Fi. In fact, a significant 11.6 percent of Tshwane Wi-Fi respondents do not have any other means of connection and 12.9 percent reported liking the fact that public Wi-Fi offers free content. A higher portion of Neotel users (22.5 percent) do not have other forms of connectivity otherwise and similarly to Tshwane Wi-Fi users, 10.2 percent of Neotel users enjoy free content offered through the platform. During a conversation with a student at the

University of Pretoria, a public Wi-Fi user candidly stated that “We love Wi-Fi. Wi-Fi is life. We love free things.” (Interview, 5 April, University of Pretoria)

In terms of public Wi-Fi use, the majority of Tshwane Wi-Fi users (58.4 percent) seem to use the public Wi-Fi for education purposes as backed up by several answers to the open question at the end of our survey. A few Tshwane Wi-Fi responses (17 in total out of 519) to the preferred location for accessing public Wi-Fi include libraries, educational institutions and school residences. Others preferred to have public Wi-Fi at home instead to do assignments and homework. Public Wi-Fi is also perceived by one respondent as an enabler for both educators and learners.

Surprisingly, when noting among multiple responses the uses of Tshwane’s public Wi-Fi, social networking (38 percent) is less common than sending and receiving emails (42.6 percent). Also, a similar number of respondents using public Wi-Fi for social networking use it to search and apply for jobs (37.6 percent). Approximately one third of respondents use public Wi-Fi for instant messaging and only one out of ten use it to communicate with local government, to report crime and for general admin. Instead, the majority of Neotel users (51.3 percent) use public Wi-Fi to search for facts and information.¹⁷¹ Similarly to Tshwane Wi-Fi users, Neotel public Wi-Fi users use the network for social networking (39.5%)

and 32.4 percent use it for email, which is less than their Tshwane counterparts. In order to improve the delivery of e-government services, local and national government websites are zero-rated on public Wi-Fi networks. Additionally, the Western Cape public Wi-Fi network hosts links to Government websites on its landing page. However, it seems that the uptake of these services is still very low among public Wi-Fi users. In fact, only 5.7 percent of Neotel users communicate with local government this way. There is a need for Government to build awareness, security and trust in e-government services in order to dispel fears relating to the loss of applications for public services and to the insecurity of personal data.

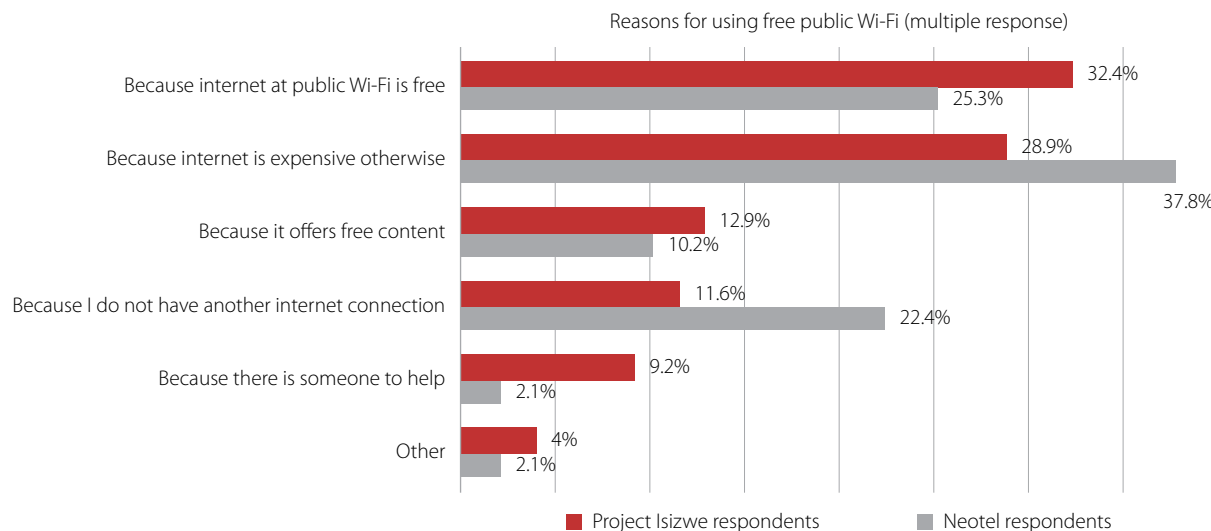


Figure 17: Reasons for using free public Wi-Fi (multiple response)

Source: RIA web surveys, 2016.

¹⁷¹ Neotel has conducted the survey independently using the same questionnaire Research ICT Africa has used for the survey on Isizwe network. However, in the question on “What do you use the public Wi-Fi hotspot to do?” Neotel did not include “Education” between the answers.

As expected, the majority of both Tshwane and Neotel respondents (72.1 percent Tshwane users and 90.6% Neotel users) use their mobile phone to connect to public Wi-Fi hotspots. However, a considerable number of Tshwane respondents (20 percent) use their personal laptop. This is indicative of the number of people using the public Wi-Fi hotspot either to

work or use for educational purposes, for example, preparing assignments or performing research is more fittingly conducted on a laptop. During the visit to the open Wi-Fi site in Church Street, Cape Town, a public Wi-Fi user tells us that people go there with laptops and tablets, especially during lunch time: “If you come here at lunch time there is

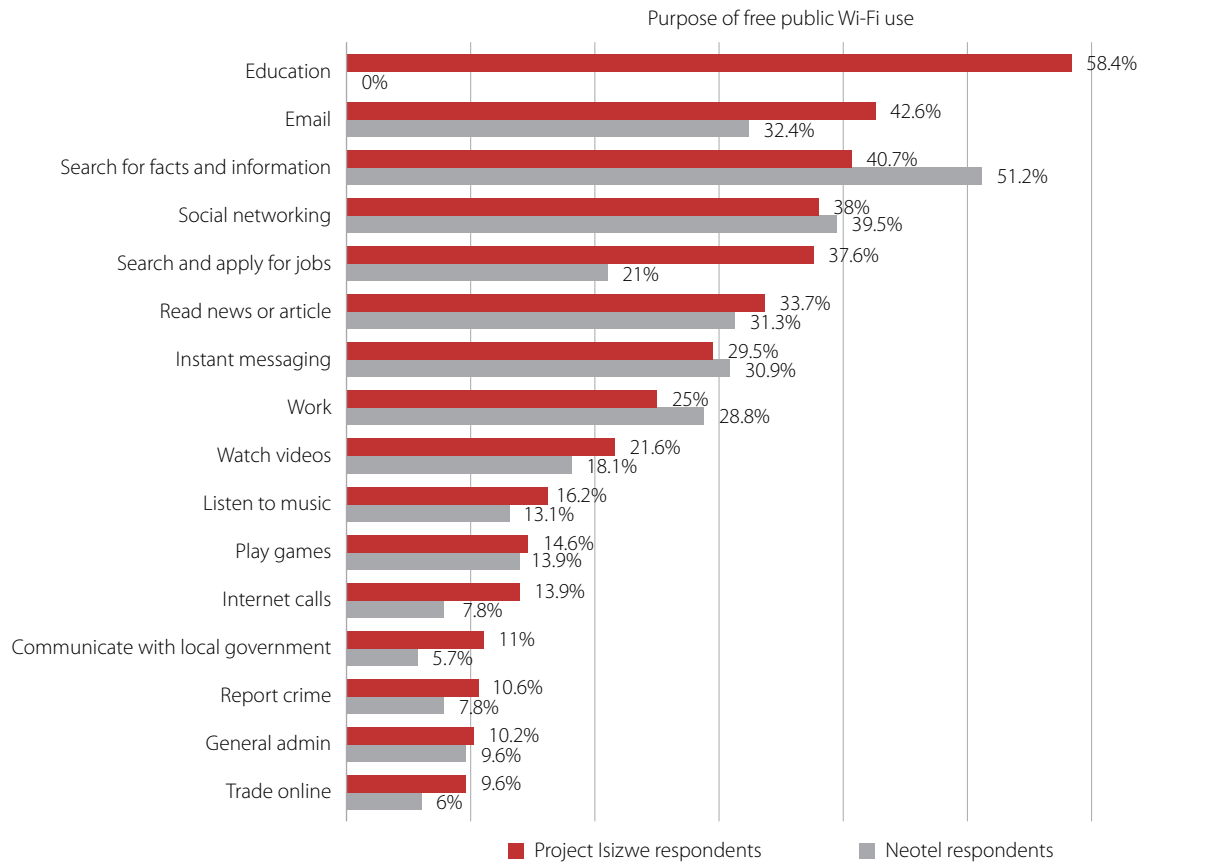


Figure 18: Purpose of free public Wi-Fi use (multiple response)

Source: RIA web surveys, 2016.

no space. If you come at lunch time you will see that people come here also to work. People come with laptops, tablets". Since the majority of people using the public Wi-Fi in Church Square are workers in the city bowl, the interviewee assumes that they use that hotspot for professional purposes (Interview, 5 April 2016, Church square).

The last question investigates the challenges faced by respondents when using a public Wi-Fi hotspot.

We experienced the problem of finding the network off-line when we visited the Isabelo bench in Adderley Street (5 April 2016). Although we managed to detect and connect to the network, we failed to access the Internet. The cause was unclear so we asked a nearby user but he claimed that his connection was working. He was attempting to send WhatsApp messages and avoid mobile data charges (5 April 2016, Isabelo bench, Cape Town). However, other users present at the same hotspot

revealed that their phones indicated network connection as well and were able to confirm that the Internet was inaccessible.

The main problem encountered by Neotel users (40.7 percent) is that they find that the network is too slow or congested. This finding is confirmed by two public Wi-Fi users we encountered in Church Square, Cape Town, on the 5 of April 2016, who affirmed that the network and its speed were unreliable. We experienced this same problem when we visited the public Wi-Fi site in the Company Gardens on the 5th of April 2016. Although we found the hotspot, the signal was simply too weak to connect.

The Tshwane public Wi-Fi signal at the University of Pretoria on the 5th of April 2016 was also too weak to connect to the Internet. Several students at the campus stated that they preferred to use the free Wi-Fi offered by the school as the Tshwane public Wi-Fi signal was too weak and unreliable.

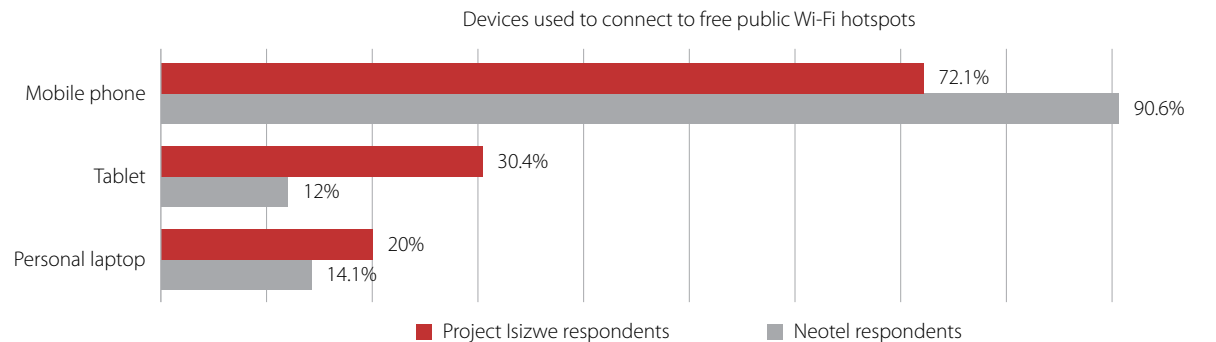


Figure 19: Devices used to connect to free public Wi-Fi hotspots (multiple response)

Source: RIA web surveys, 2016.

During our visit to Mamelodi on the 6th of April 2016, we found the signal to be sporadic. We found a stronger signal outside schools, at the police station and the municipal offices. Public Wi-Fi users stated that the network would often get congested and that it did not cover a wide radius beyond the schools. Other challenges stated by public Wi-Fi users in Mamelodi included dropped signals and the inability to locate the Mamelodi Community Centre located at 621 Stormvoel Road, which was listed as a public Wi-Fi hotspot (6th April 2016, Mamelodi Tshwane).

Nevertheless, when we tested the speed of the Western Cape hotspots in Woodstock and Parow using the MySpeedTest app we were positively

surprised by the speeds: both hotspots' download speeds were higher than 1.9Mbps and upload speeds were faster than 1.2Mbps. Those are very high performances for public Wi-Fi access points and these speeds allow users to perform any activity online including video and music streaming. However, it is worth noting the case of the St. Agnes school in Woodstock where we were the only two users using the public Wi-Fi hotspot. Similarly, on Monday the 24th of April, we could not see other users at the Parow and Goodwood sites.

Another barrier identified during the ethnographic study to using public Wi-Fi is the cost of a Wi-Fi-enabled device. Some of the respondents during our study had internet-enabled phones like the one

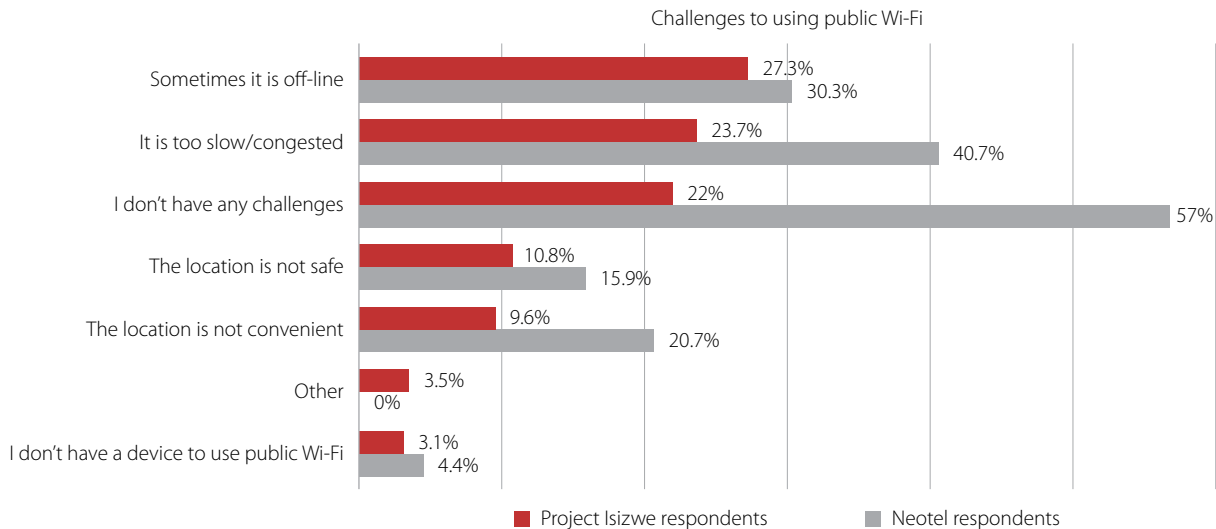


Figure 20: Challenges to using public Wi-Fi (multiple response)

Source: RIA web surveys, 2016.

in Figure 21 below, but the devices were not Wi-Fi-enabled as they could not afford such devices, therefore some of the respondents were not able to benefit from the free Wi-Fi service.



Figure 21: Example of an internet-enabled phone that cannot access Wi-Fi networks

On a positive note, a significant group of respondents (22 percent) do not have any challenges using public Wi-Fi. We also had a very positive experience the first time we visited the Neotel public Wi-Fi hotspots in Woodstock and in Long Street, Cape Town. People in the Western

Cape know they have clearly arrived on a Wi-Fi hotspot once they see the sign in a Wi-Fi Zone (Figure 22 below).



Figure 22: Sign marking a free public Wi-Fi zone

The sign simply indicates where a public Wi-Fi hotspot is and how to set up and connect to the Wi-Fi hotspot. There are no barriers to entry such as registering or going via several links to go online. In comparison to sites such as AlwaysOn or Telkom Wi-Fi, this is an easier option for Internet users – new and old users alike.

Church Square is the main point where people go over lunch. Everyone was on their phone or tablet. It is a student district yet they do not feel safe to use

the laptop. However, a user said he uses his laptop at school because it feels safer.

Safety and security do not seem to be a big concern for public Wi-Fi users since only 10.8 percent of them express that this is a concern. Similarly, only one out of 10 respondents declare that the location is inconvenient.

However, during our second visit to the Neotel public Wi-Fi hotspot at St Agnes in Woodstock (6 June 2016) with two experts of network security we realised that the open Wi-Fi hotspot can be unsafe from a cyber-security perspective. It is possible to sniff passwords or cookies over an open Wi-Fi network. Specifically, an attacker within the reception range of an unencrypted Wi-Fi access point can insert himself as a man-in-the-middle. In this well-known cyber-attack, an attacker secretly intercepts communications passing between users and a public Wi-Fi router.

The landing page provides information on accessing the Internet, on the free data that one has for the day and an explanation for the types of data one can get (i.e. mobile data or Wi-Fi data). The free 250MB of data is for the month to be used with any Neotel public Wi-Fi hotspot. After the free data cap is depleted, one can buy vouchers at Engen garages or Spar shops and redeem them on the landing page.

The last question of the online survey asks to list the preferred place to access public Wi-Fi. An overwhelming majority of respondents' assert that their preferred place to access public Wi-Fi hotspots

is at home for a few reasons: Because they "need to do research on school projects till very late", or "so [they] can use it for maths and project homework" and of course it "would be the safest". The preference of the public Wi-Fi to be accessible from home is also "because I will avoid to go out at night to the public school or library", or simply for greater comfort.

Another interesting factor regarding home being the preferred place to access Wi-Fi was the issue of convenience and weather. During our visit to Mamelodi on the 6th of April 2016, the weather was wet and cold and most users stated that there were no shelters outside the schools and Wi-Fi hotspots. In our discussions, several respondents noted that it was common to find a group of people sitting outside the various schools in the community or standing next to street lights on which Wi-Fi masts had been mounted, but this was not the case during our visit to Mamelodi. Some Wi-Fi users stated that the weather was a barrier to the use of Wi-Fi and some of the public Wi-Fi sites were far from their homes, thus they would benefit if coverage was extended to their homes.

POLICY-RELATED FINDINGS

The FPW projects reviewed in this study were very different, still evolving and context-specific, making direct, side-by-side comparisons difficult. However, the many findings that should be of interest to decision-makers are summarised below:

The provision of FPW is an established practice globally and now has a track record in South Africa.

The argument for providing FPW from government buildings is supported by the following points:

- Penetration of smartphones is high and growing in the low-LSM groups.
- Smartphones (as well as phablets and tablets) offer a convenient and worthwhile experience for general consumption, although not for complex tasks better suited to one or multiple large screens (publishing layout and financial modelling, to name two tasks).
- Most South Africans access the Internet primarily via cellphones, but have limited access to a true “broadband experience” due to the high costs of mobile data and limited 3G and LTE coverage.
- Public buildings are the ideal locations for Wi-Fi APs as the costs of providing connectivity, power and security are already covered by existing budgets. All projects reviewed make use of public buildings. Public buildings can be found in both city centres and remote rural locations.

Given that government buildings (or spaces) can reduce the costs of Wi-Fi provisioning, connectivity to government buildings should consider three separate (although overlapping) policy objectives: to connect government staff; to provide broadband access for visitors; and to connect nearby homes and businesses. The following building types are recommended for prioritisation in a FPW project:

- Educational institutions should be the top priority. Schools are the most common government buildings and found in remote wards. Students readily take up broadband and require access for their education and assignments. Measured uptake and recorded feedback was positive and there was equal uptake by gender. School connectivity is a specific SA Connect target and managed at the provincial level. Usable educational content is available to complement school programmes.
- Clinics are also targeted across a number of projects. Clinics are widespread and also found in remote wards. Specific feedback on these projects was limited, although there is focus on providing supporting health content and services. The use of video-on-demand content makes sense, to complement television as a proven medium for health education.

- Public open spaces (rather than buildings as such) were targeted in one or two projects and this is consistent with global practice but also promotes a range of outcomes (from tourism to social discourse).
- Libraries have been targeted by a number of projects and a priority in all. Specific feedback on these projects was limited, although in the US, digital inclusion projects highlighted the benefits of having indoor access via both Wi-Fi and workstations, and with the librarian trained to assist (for example, with seeking jobs and completing résumés).
- Cultural buildings (such as museums) are typically connected for Wi-Fi in other countries but were not a focus in South Africa.
- A number of other public building types were commonly included in projects, most likely because they played a central role in the life of a community (including community centres and multi-purpose centres).
- A number of buildings were chosen, regardless of category, because of location in a high footfall or high population area, or because sites needed to be geographically dispersed.
- No review of agricultural extension was undertaken. Other connectivity projects have provided connected kiosks for farmers, but not Wi-Fi *per se*. The existing projects are in urban areas and the Western Cape provincial

project is still underway.

- All of the projects reviewed appeared to be extending coverage and aiming to create a radius of connectivity (from 100m to 200m) around public buildings. This is an important issue when considering equipment to use.

Most projects were closely linked to the provision of fibre to connect businesses and buildings:

- Wi-Fi provisioning often piggy-backed on the connectivity project itself (Ekurhuleni, Western Cape).
- Wi-Fi sometimes benefited from existing connectivity (cities of Cape Town, Tshwane).
- The benefit of the complementary approach was that Wi-Fi approval was expedited (in other words an authority approves a combined fibre/Wi-Fi project more readily than a Wi-Fi-only project).
- Furthermore, Wi-Fi was (and should be) planned as part of a holistic ICT intervention.
- The disadvantage of a complementary approach is that objectives and costs are not as easily disaggregated. Wi-Fi does ultimately need to have a stand-alone motivation in order to be sustainable.

South Africa's wealthiest two provinces (Gauteng and Western Cape) and wealthiest four cities (Johannesburg, Cape Town, Tshwane and Ekurhuleni) all have FPW programmes. There are no significant initiatives in the implementation stage in the rest of

the country. All government entities, but particularly the poorer provinces, cities and towns are facing stark resource and infrastructure challenges. Wi-Fi can reduce the digital divide only if there is urgent investment beyond the current initiatives.

Project Isizwe has demonstrated a successful city rollout in Tshwane. The model and pricing are well understood and Project Isizwe could well replicate this at short notice across multiple sites in the country (or across Africa), provided funding was available. Deployment in Tshwane has been rapid. However, the following caveats would apply:

- The relationship between the non-profit organisation (Project Isizwe) and the commercial implementing partner (Herotel) did raise questions. The founder of Isizwe has grown Herotel (to some extent) on the back of the Tshwane business and then exited Isizwe to grow Herotel. The developments are not necessarily sinister. However, Project Isizwe now needs to establish a stand-alone track record and show distance from Herotel. Certainly the new CEO and the ongoing CTO have developed substantial experience.
- Government projects should go out to tender. Tender documents should require the type of value-adds, content, quality and service levels that Project Isizwe provides.
- Project Isizwe's current model requires ongoing funding, and local authorities must

ensure a long-term commitment (at the very least 3–5 years) is in place – enough time to bootstrap the local broadband ecosystem.

- Isizwe's "take it or leave it" approach is a logical one, because the authority funds the project. However, more user feedback could be taken by Isizwe to provide services such as its WiFi TV and Tobetsa.

Local authorities that have the resources and management capacity are deploying fibre projects (with Wi-Fi outcomes often dependent on the fibre outcome). Cape Town is deploying fibre and expanding Wi-Fi. Ekurhuleni is deploying its network rapidly, using a primary contractor. Tshwane is finalising an additional phase to its current network. However, the success of such projects is very dependent on the management capacity of the authority at the time: Both Johannesburg and eThekweni (Durban) commenced fibre rollout with grand plans, only to see delays, cost over-runs and controversy.

Although Wi-Fi is largely situated in cities and towns, provincial authorities should at least coordinate activities, but are also encouraged to support and expand initiatives.

Provincial coordination (between provincial and municipal authorities and the private sector) is essential to optimise returns.

Coordination of fibre deployment is very important and forms the basis for optimising Wi-Fi deployment.

Coordination of hotspot deployment can give

greater benefit at lower cost. For example, the commercial centre of Parkview (in Johannesburg) offers free Wi-Fi in four adjacent (but not mutually supportive) projects: a shopping area (provided for by residents), a library (provided by Johannesburg City) and two schools (provided by Gauteng Province).

Education is a provincial function. Provincial-level school connectivity (with Wi-Fi internally and externally) should be coordinated, reported on and (where appropriate) funded at provincial level.

Nevertheless, cities are often further advanced in their planning than provinces and should not be held back in deploying.

The overall broadband-stimulation programme should also be coordinated. Planners should consider both how to drive Wi-Fi and how the features of Wi-Fi can enhance these projects.

Provincial authorities should also deploy directly (outside of active municipal projects), as the Western Cape has done.

- The Western Cape chose to pursue a PPP model (well-suited for deployment in rural areas), and progress is promising (being in budget and on track).
- Although the Western Cape is still testing the waters, placing one Wi-Fi site per ward, the learning around uptake in certain building categories suggests that a more substantive project is feasible. Such a project would commence with Wi-Fi at all higher and

secondary education institutions, then provide coverage at all schools (which should be prioritised for connection in any event), and then move to libraries and community centres. This approach could be based on a PPP model, or an organisation like Project Isizwe, and could even be funded and coordinated at national government level.

All of the projects were conceived within a broader planning context aimed at promoting broadband.

- Initiatives are variously known as “Smart City” or “Smart Province” or “Broadband Stimulation” initiatives.
- Planning includes e-Government initiatives across multiple sectors (such as health and education). In spite of significant mention of project plans for portals and applications, most are still in early development and have yet to report information on impact. The focus has been on physical network rollout.
- Project Isizwe’s Tshwane content portal is exceptional and could be regarded as a benchmark for all projects. Authorities who do not have mature offerings need to engage Project Isizwe regarding replication, possibly through licensing of the platform. Isizwe’s portal offers what most government departments are planning – government-specific information and interaction, as well as content that is deemed helpful to the target

market, such as employment opportunities, entrepreneur support, health information, educational content and news with a strong local contribution.

- The “Free Basics” initiative (“Internet.org”) initiated by Facebook is worth monitoring. It offers basic content access for free with subscribers able to pay for more comprehensive content. Cell C offers mobile access to this content in South Africa, but Project Isizwe is trialling access to it via Wi-Fi (in Limpopo Province).

No significant policy findings arose relating to demographics (particularly age and gender). Project Isizwe provided more detailed information during its early deployment, when coverage was predominantly at educational institutions. Youth uptake was high and participation by gender was close to equivalent.

One of the key policy questions is the extent to which government should be investing directly in a free service, and to what extent it should rather be stimulating investment and encouraging business models that provide low-cost service.

Concerns have been raised globally about the anti-competitive implications of a public entity investing directly in competition with private sector initiatives.

- Projects in South Africa have been less criticised, probably against the backdrop of the sheer lack of affordable broadband access.
- Concerns do need to be addressed to ensure

that when the state engages in service provision, it does not deploy public resources in projects that effectively inhibit private sector investment.

- Tshwane Free Wi-Fi warrants further discussion in this regard, as government has invested public funds to provide a single-operator service. Not only would private sector competitors be discouraged from investing, but they would find it difficult to compete in Wi-Fi service provision, because the government network utilises key high-sites and government fibre backhaul.
- That is not to conclude that government should not invest in FPW, but rather to suggest caution when alternative investment models exist.

The concept of “open access” is topical for broadband infrastructure provisioning (for example, with fibre provisioning and LTE deployment). Open access Wi-Fi (at the OSI layer 2 level) means that a single infrastructure provider installs Wi-Fi APs and Internet backhaul, allowing multiple service providers to compete and offer Internet access to end-users across this open access network. The approach promises to reduce overall infrastructure costs and obviate radio interference between Wi-Fi networks, while stimulating a level of competition.

An open access model has been tested in Cape Town’s Mitchell’s Plain/Khayelitsha pilot, with Cape Town

indicating its intention to extend project. If the tender proceeds, it is a sign of confidence in the approach and also an opportunity for further data gathering.

Public-private partnerships (PPP's) are a popular approach to fostering investment in infrastructure and the exact models take many forms. The Western Cape/Neotel project should be watched to evaluate one promising such PPP model, in which government stimulates private investment and reduces risk by both co-investing and committing considerable business as an “anchor tenant”. The private operator also makes a considerable investment based on planned return from its own marketed products and services. The risk and cost is higher outside the large metropolises. The concept of “anchor tenant” is envisaged in SA Connect.

There are multiple sources of return for an investment in Wi-Fi services, whether the investment is by government or private sector sponsors. The options are complex, but a simplistic model would include the following:

- **Economic growth.** All projects (local and international) promote the view that the economic growth of an area will create more value than is spent on a project (an economic return). The benefits enhance economic production, job creation, local competitiveness, skills attraction, as well as that of tourism and business investment to the point of possibly establishing an economic

growth hub. For a local authority, an expected secondary benefit is an increase in taxable activity.

- **Digital inclusion.** All projects promote the view of including a higher percentage of citizens in the benefits of the digital age and providing improved communication and access to information on, for example, health, education and job opportunities. Alternatively, FPW promotes social interaction in open spaces.
- **Advertising.** Sponsored Wi-Fi has considerable growth potential with the differentiator being that it is highly targeted, being more personal and allowing a higher level of customer interaction than traditional media, such as radio and TV. The Western Cape is the only authority to encourage its FPW providers to explore such options, but there are no examples to study.
- **Analytics.** Wi-Fi offers rich analytics capabilities, which can be used to enhance the targeting in advertising; to enhance government planning (for example, to understand routes used on public transport and at transport nodes); and by the private sector (such as detailed individual behaviour at shopping centres). The opportunity is not-well developed in South Africa, but has been developed internationally by companies such as Google and needs further consideration. Due attention should be given

to the privacy rights of individuals, especially when analytics are used for individual customer interaction. Much of the analytic data is useful as aggregated information (without needing to know details of individuals).

- **Freemium service.** The model involves offering a basic service for free, and charging for additional value. The conventional Public Wi-Fi model (common amongst commercial operators) is to offer a free bundle and charge for additional data. There is not strong evidence of significant take-up beyond the free allocation. Isizwe has been strongly against this model, claiming it does not work in other parts of the world. The Western Cape encourages the option, and the Home of Compassion pilot has shown some evidence of uptake (partly because their initial free offering of 50MB per day is smaller than the 250–300MB standard in South Africa). The CoCT model (using commercial ISPs to offer the free service on city infrastructure) may also result in this model. The alternative “Free Basics” model (already described above), piloted by Project Isizwe in Limpopo, offers free access to certain health, education, employment and social networking sites. This is a model to watch closely once results become available.

The emergence of FPW is an exciting development in South Africa. Sustainable models to promote

inclusive broadband should be explored and replicated. The fact that the larger projects are clustered in the wealthier provinces and cities suggests that expansion will be severely limited by organisational capacity and budget. Policymakers will, therefore, have to focus on increasing private investment (based on models already mentioned) by fostering new innovations and business models that will draw the private sector into offering free and reduced-cost Wi-Fi on a significant scale. There is enough groundswell of existing private free-Wi-Fi initiatives to suggest that widespread replication is possible, provided new innovative models can be found (including appropriate PPP models) to provide low-cost, Wi-Fi-based broadband services.

Conclusions and policy recommendations

The connectivity model provided by public Wi-Fi networks may become a way to bridge the access gap at a household level as it provides an alternative access model to expensive mobile data services and fixed broadband. However, a few obstacles for an optimal rollout of public Wi-Fi, and use of the service, remain. Public Wi-Fi provides complementary broadband access to mobile data. Project Isizwe’s daily volume cap provides enough data for users to carry out almost all Internet activities. In comparison, the Western Cape projects require data top-ups for optimal use. These public Wi-Fi network operators supply data

at a much cheaper margin when compared to local mobile network operators. They can do that because usually the backhaul infrastructure is subsidised by a government organisation and the cost of rolling out access networks are low. However, their coverage is limited to selected public buildings and public spaces, leaving almost all households uncovered. In addition, although the quality of the connection seems sufficiently good when the hotspot works, one of the main barriers to accessing public Wi-Fi is that the network is unreliable. Public Wi-Fi models may thus be a solution to overcoming cost as a barrier to access, but their coverage is still limited. In addition to that, only Wi-Fi-enabled devices can connect to these networks, leaving those who cannot afford these devices disconnected from the Internet.

Our research findings show that the users of FPW are mostly young people between the ages of 15 and 35, slightly more represented by males, and identified as students or employed people with educational qualifications between primary school and an undergraduate degree. Use of public Wi-Fi hotspots is mostly for educational endeavours as well as emailing, social networking and job searching among other messaging and entertainment activities. Although cellular phones are the most popular device for connectivity, tablets and laptops are also well-suited and used for these activities, especially in public areas where users feel safe to use these devices.

One shortcoming of this study was its bias in favour of FPW users when many people can be assumed to not be using such services. The one finding this study can contribute on this matter is that Wi-Fi-enabled smartphones are also in short supply and prohibit people's use of publicly-provided connectivity. Not all smartphones are Wi-Fi-enabled and people using phones without such a feature could miss out on the benefits of broadband access that come from FPW.

Despite hotspots having been placed near to public/government buildings, and various actors having provided extensive network coverage, the FPW network is far from being ubiquitous and most households remain uncovered. This undermines the low-cost competition that FPW poses to high mobile data costs and should be the target of future policies and research. What stood out from our findings is the location of these sites. It may be unsurprising to acknowledge the limited funding, and hence limited coverage, of FPW networks, but restricting access to within about 100 metres of government/public buildings does not always target the most popular clusters of people. Weather and security conditions also limit the ease of access of FPW hotspots, which ought to lead to a rethinking of possible public provision plans, especially to prioritise access from the home or building where people find it more conducive to use. Below are some recommendations.

To investigate the pricing difference between operators a little deeper, it should be noted that Project Isizwe's operation is completely funded by the Tshwane Municipality, which alleviates much of the risk. Since Neotel and the NPO operators in the Western Cape receive infrastructural investment or partial grant funding, they are encouraged to freely pursue other commercial opportunities to increase their revenue stream, such as limiting data allocation and incentivising supplemental voucher purchases.

This does, however, bring into question the sustainability of Project Isizwe's model in Tshwane as such funding should realistically run out at some point. Hence, the options available to NPOs and network operators to recoup their investments are unclear after the initial public finding period comes to an end. If not considered, the idea of providing universal, ubiquitous and free access to broadband services is unrealistic.

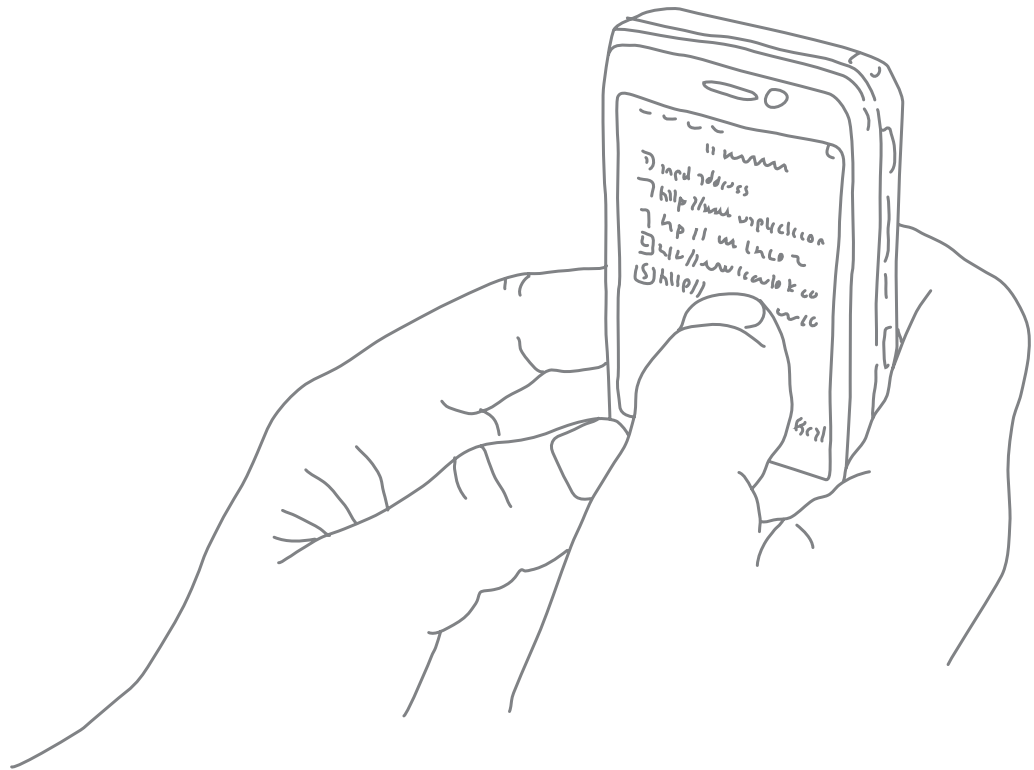
One popular model of supply is the open access model which provides a non-discriminatory and transparent market for vertically-separated infrastructure owners, network operators and ISPs. A publicly-funded fibre metropolitan link operated as a public wholesale infrastructure would reduce leased-line costs for multiple WISPs. One main benefit of such a model is the reduction of the prices users pay for access since wireless broadband providers are forced to openly compete with each other to invest in local access infrastructure,

maintain the network and provide wireless broadband connectivity. Although these models are best suited for "greenfields" scenarios such as the undersea cable networks, their applicability to municipal networks is being debated.

In the public Wi-Fi context, if municipalities and other local and/or regional public actors were prepared to invest in a network as the City of Tshwane and the Western Cape Government have done, then they should look at providing backbone infrastructure at their own cost and sell cost-based connectivity to smaller public Wi-Fi operators who would be free to operate their own wireless access network and recoup revenue in their own innovative ways. Low tenancy rates, transparent pricing models and non-discriminatory practices would reduce the risk involved with public expenditure. Moreover, given the advance in Wi-Fi technological capacity, the ability of operators to reach increasingly distant areas would improve. This, combined with a smart procurement strategy that grants anchor tenancy to public institutions in smaller town and villages surrounding large metropolitans, could provide a network of network that would not need to cover the entire country with Wi-Fi signals but only complement other models of broadband provision, such as mobile data.

Lastly, it would be important to collect longitudinal data that can be used to observe changes in public Wi-Fi access and use over time. The results can be

used to better design public policy not only related to Internet access but also to the improvement of public service delivery. Given that there are some unmetered offerings, such as government and educational websites, the extent and scope of use can assist in determining if the information online is sufficient. At the same time, the demand-side results can establish whether using a public Wi-Fi model to increase access and use indeed works.



APPENDICES

Appendix 1: Online questionnaire

Thank you for taking the time to answer the following questions. Please answer all our questions. You will stand a chance to win Internet Wi-Fi vouchers! The anonymity of responses is guaranteed. Please note: the definition of a public Wi-Fi hotspot is a public location (for example school or library) where Wi-Fi access is free.

- 1) Why do you access the internet at the public Wi-Fi hotspot?
 - a. because internet is expensive otherwise
 - b. because internet at public Wi-Fi is free
 - c. because I do not have another internet connection
 - d. because it offers free content
 - e. because there is someone to help
 - f. Other (please specify) _____

- 2) What do you use the public Wi-Fi hotspot to do?
 - a. Emails
 - b. Work
 - c. Education
 - d. Read news or articles
 - e. Search for facts and information
 - f. Social networking (e.g. Facebook, Twitter)
 - g. Instant messaging (e.g. WhatsApp messages, BBM)
 - h. Internet calls (e.g. Skype, WhatsApp voice)
 - i. General admin (e.g. paying bills, submitting tax)
 - j. Communicate with local government
 - k. Search and apply for jobs
 - l. Watch videos
 - m. Listen to music
 - n. Play games
 - o. Trade online (e.g. selling/buying on Gumtree)
 - p. Report crime

- 3) What devices do you use to connect to a public Wi-Fi hotspot?
 - a. Personal laptop
 - b. Tablet
 - c. Mobile phone

- 4) How old are you?
 - a. under 16
 - b. between 16 and 25
 - c. between 26 and 35
 - d. between 36 and 50
 - e. above 50

- 5) Sex:
 - a. Male
 - b. Female

- 6) What qualifications do you have? (check boxes)
 - a. None
 - b. Primary
 - c. Matric
 - d. Diploma/certificate/vocational
 - e. Undergraduate
 - f. Postgraduate

- 7) What has been your main activity during the last 6 months?
 - a. student/pupil
 - b. unpaid house work
 - c. retired
 - d. unemployed
 - e. disabled and unable to work
 - f. employed
 - g. self-employed

8) Please list in your own words what would be your preferred place to access public Wi-Fi hotspots.
For example, on public transport vehicles, at home, at the mall, at the barber shop, etc.

9) How often do you visit the public Wi-Fi hotspot?

- a. More than once a day
- b. Once a day
- c. 2 to 5 times per week
- d. Once a week
- e. 2 to 3 times a month
- f. Once a month
- g. Less than once a month

10) On average, how long do you spend at the public Wi-Fi hotspot?

- a. 5 minutes
- b. between 6 and 30 minutes
- c. between 31 minutes and 1 hour
- d. between more than 1 and 3 hours
- e. More than 3 hours

11) How often do access the public Wi-Fi hotspot at:

- | | |
|--------------------------------|--------------------------|
| a. Library | [Never] [Seldom] [Often] |
| b. School | [Never] [Seldom] [Often] |
| c. University | [Never] [Seldom] [Often] |
| d. Community centre | [Never] [Seldom] [Often] |
| e. Public building | [Never] [Seldom] [Often] |
| f. Public transport terminal | [Never] [Seldom] [Often] |
| g. Public square | [Never] [Seldom] [Often] |
| h. Tourism and heritage venue | [Never] [Seldom] [Often] |
| i. Cafes, pubs and restaurants | [Never] [Seldom] [Often] |
| j. Shopping centre | [Never] [Seldom] [Often] |

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