

Implications of Over-The-Top (OTT) Services on National Security

Fowora Damilola Kalesanwo Olamide* Awodele Oludele Joshua Vincent
School of Computing and Engineering Sciences, Babcock University, Ilishan Remo, Ogun State Nigeria

Abstract

The telecom industry is an industry that has to deal with a continuous rapid changing business and technological environment, unlike other industries. Traditionally, the principal revenue streams for telecom operators have been the voice and messaging (SMS) with data coming in at a far third till recently. The internet explosion has led to the inception of diverse internet applications and services amidst which, OTT is one. The proliferation of Internet-based services and applications has given rise to data traffic increase for telecom operators. The growing impact of OTT services on telcos' voice and messaging revenue is a widely accepted phenomenon that is making telecom operators lose revenue in a rapid manner. Other than the challenges OTT pose on telecom industries, the threat it also poses to national security as a result of its operation under net neutrality is a critical point that needs to be considered. This article highlights the wide adoption of OTT services, its' devastating impact on telecom operators and its impact on national security.

Keywords: Telecom, OTT, Net Neutrality, National Security.

1. Introduction

OTT which means "Over-The-Top" is a term that is used for the transmission of multimedia contents be it audio, video, texts, or other media documents over the internet without necessarily passing through telecommunication service providers (Sahil, 2015). Telecommunication service provider or telecom providers are the ones usually responsible for the provision or transmission of telecommunication services. They have the responsibility of accepting, transmitting and delivering messages to users (National Telecommunications Information Administration, 1997). The Federal Communication Commission (FCC) defined telecommunication service as "the services provided by telecommunication service providers directly to the public for a fee irrespective of the facilities used in providing those services." This definition shows that it is mandatory for consumers to pay for telecommunication services they enjoy. Unlike the normal telecommunication service providers, OTT services do not require any sophisticated infrastructures because contents are delivered over the internet and hence, consumers do not necessarily pay for services rendered.

Communication is a basic need of life and communication companies have always been classified as institutions that provide socio-economic services. It is therefore essential that the services provided must at all times reflect the state of the wellbeing of that community or its people (Ehijeagbon, 2003).

Telecommunications and indeed communication services, in general, has transited from first generation cellular networks to third and more recently fourth-generation networks (which largely ride on internet protocol) in various parts of the world. (NCC, 2016).

The access to 3G and 4G networks which offer mobile broadband and high-speed IP data networks has further encouraged the uptake and growth of new modes of communication such as over-the-top (OTT) services which in turn enables the provision of services such as live streaming, and voice over internet protocol (VoIP).

These OTT services are provided through the Internet Protocol Telephony which is a general term for the technologies that use Internet Protocols packet-switched connections to exchange voice, fax and other forms of information that have traditionally been carried over the dedicated circuit-switched connections of the public switched telephone network (PSTN).

OTT services include services provided by apps like Whatsapp, Facebook, viber, imo, twitter skype, etc. they are considered services that telecoms carriers claim are posing threat to the core of their business. The NCC described OTTs as services carried over the networks, delivering value to customers, but without any carrier service provider being involved in planning, selling, provisioning, or servicing them. The NCC says this means traditional telecoms firms cannot directly earn revenue from OTTs (Kazeem, 2016),

OTT services (e.g. IP telephony) is competing with mobile phone networks by offering free or lower cost connections via WiFi hotspots." It is a service based on the Voice over IP communication protocol (VoIP). VoIP is also used on private wireless networks which may or may not have a connection to the outside telephone network (Patel, 2007). It is rapidly gaining ground against traditional telephone network technologies.

According to Patel, (2007) "Internet Protocol (IP) telephony (also known as 'Internet telephony') uses a broadband Internet connection to transmit conversations as data packets. In addition to replacing the traditional Plain Old Telephone Service (POTS) system.

According to Wong, et. al. (2009) "VoIP is a technology by which oral communications can be transferred from circuit-switched networks to or over Internet Protocol networks, and vice versa. VoIP transforms standard

oral telephone signals into compressed data packets that are sent over the Internet Protocol. VoIP can be used with either a telephone (mobile or land-line) or a PC as the user terminal thereby providing different modes of operation: PC to PC, PC to telephone, telephone to PC and telephone to telephone or mobile-to-mobile, all via the internet.”

The inability for telecom firms to earn enough revenue from OTT is a challenge. The loss of revenue claimed to be a result of the wide adoption and utilization of the mobile messaging and internet calls that are fast replacing traditional calls and SMS (Kazeem, 2016). Telecom technologies have advanced overtime especially radio access. It has evolved from GSM and CDMA technology to third generation technologies that uses the WCDMA, TD-SCDMA, CDMA2000, down to the fourth generation technologies that uses TD-LTE, FD-LTE, LTE-A. The plan to deploy the fifth generation is on its way and is slated to be rolled out in 2020. These advancements in technology have provided end user data rates that are relatively satisfactory, which were not in existence a decade ago. The improved data rate can be associated with the adoption of OTT services like video calls and multimedia services that are dependent on data services and thus consume lot of bandwidth. The advancement in mobile phone technology is another factor that has driven the wide adoption of OTT services. Evolution of mobile devices from feature-phone to technologically advanced smartphone has allowed data streaming, which is one of the most prominent enablers for any OTT. Major OTT applications include; Skype, Whatsapp, LINE, Wechat, Viber, IMO, 2go, etc.

The nature of OTT service delivery has made its regulation somewhat challenging. Services are delivered over the internet, therefore, regulating it is tantamount to regulating the internet which seems not to be in accordance with internet neutrality. Its non-regulation makes it a perfect platform to carry out crime and other terrorism-related activities without the violation of any right/law.

2. Review of Literature

Federal Communications Commission [FCC] defines Voice over Internet Protocol (VoIP) –an OTT services, as “a technology that allows you to make voice calls using a broadband Internet connection instead of a regular (or analogue) phone line. They further noted that while some VoIP services may only allow you to call other people using the same service, others may allow you to call anyone who has a telephone number - including local, long distance, mobile, and international numbers. Also, while some VoIP services only work over your computer or a special VoIP phone, other services allow you to use a traditional phone connected to a VoIP adapter.”

The FCC noted that “VoIP services convert your voice into a digital signal that travels over the Internet. If you are calling a regular phone number, the signal is converted to a regular telephone signal before it reaches the destination. VoIP can allow you to make a call directly from a computer, a special VoIP phone, or a traditional phone connected to a special adapter. In addition, wireless "hot spots" allow you to connect to the Internet and may enable you to use VoIP service wirelessly.” Rezac & Voznak (2010) further notes that “The difference between VoIP calls and PSTN calls is the way the subscriber's information (i.e., the voice communication) is transmitted. In PSTN calls, a dedicated connection is set up end-to-end so that the calling and called parties have full use of that circuit at all times until the call is completed and the circuit is torn down. In VoIP calls, the calling and called parties' voice communications "packetize," that is they are broken up into small pieces or packets, which are transmitted across the Internet and finally reassembled at the destination point." When the voice packets traverse the Internet they mix with many other packets of information traversing that same circuit, so the circuit is not dedicated to only that one voice call, but rather is acting as a highway transporting a large number of packets from their origination points to their destination points”.

Wong, et. al. (2009) however notes that “the regulation of OTT services in Europe is slightly complex because there is no consensus over the categorization of OTT services.

The European Commission takes a "light touch" approach to OTT regulation. Whether OTT service is regulated would depend on whether an OTT service is considered as an Electronic Communication Service (ECS) or a Publicly Available Telecommunications Service (PATS).”

According to Wong, et. al. (2009) “An ECS is defined in the EU Framework Directive as a service normally provided for remuneration, which consists wholly or mainly in the conveyance of signals on electronic communications networks.

Different countries have at some point or the other attempted to or developed a framework to regulate the provision of VoIP services. Some of these countries include:

India:

The Telecom Regulatory Authority of India [TRAI] noted that the starting point for a suitable regulatory framework is the need to define the basis for classification of OTT players either as Communications Service Providers (CSPs) or as Application Service Providers (ASPs).

A conclusion was reached by identifying that:

1. Traditional Voice calling rate in India is one of the lowest in the world implying that there can compete favourably with VoIP service providers;

2. Mobile Internet penetration rate is still very low in India (about 20%) therefore implying that the uptake of OTT services or substitutability of traditional telephony with VoIP services is relatively low; and
3. Quality of service of OTT services is lower than what is offered by traditional telephony services.

However, OTT services are still unpopular with mobile carriers in India. One of the Telephone Service Providers in India (Bharti Airtel) recently announced differentiated tariff plans for voice calls over the Internet and data surfing as VoIP calls were charged almost three times more than regular data surfing in the bid to earn higher revenue. However, this tariff plan was eventually withdrawn following protests by users who accused the TSP of violating the principles of net neutrality. Regarded as essential ground for an open internet, net neutrality standards mean that mobile carriers should treat all data equally and not impose differential treatment or charges on different kinds of data.

United States:

The FCC publicly states that it encourages competition and service provider innovation for the Internet as a whole, but it has also worked to bring specific VoIP services, applications, and capabilities under its control. According to the FCC (FCC, 2015), the U.S regulates VoIP to allow emergency services, compliance of VoIP with Local Number Portability rules, government access to call records, universal service fund, accessibility for physically challenged. However, in a recent move in the year 2015, the FCC voted to regulate broadband Internet services as a public utility. The vote implies that high-speed Internet in the US has been reclassified as a telecommunications service instead of an information service under their Telecommunications Act thereby granting the FCC powers to regulate the activities of players like the OTT service providers in the market.

According to Joshi *et al*, 2016, the national regulator sanctioned the blocking of Kakao Talk Service in South Korea. Services of OTT in some countries have either been blocked or the traffic speed had been reduced by telecom companies. However, users can get access to the blocked content using VPNs. "In UAE, Etisalat (incumbent operator) has out-rightly blocked VoIP services for using their network and cannibalizing revenue, such blocking of voice OTT blocking has been possible only because of the fact that UAE is a highly regulated market and Etisalat has the support of telecom regulator" (Joshi et al., 2016).

3. Internet Penetration and OTT applications

Another worrisome trend for telcos is the fact that the number of OTT voice applications continue to increase. Initially, it was majorly Skype, but several others like WhatsApp, Facebook, BlackBerry Messenger and Viber have joined the trail, making these applications more and more popular in the country. An estimate says that as much as 45% of Nigerian Internet users are active subscribers of WhatsApp alone. This means that a whole more Nigerians can use these apps for placing calls without paying a dime.

Adoption of OTT messaging is very closely linked to smartphone and mobile broadband penetration. While in matured markets growth in smartphone and mobile broadband penetration has been a key driver for increased OTT messaging adoption, in many developing markets this penetration itself has been fuelled to an extent by the consumers' desire to use OTT messaging services such as WhatsApp.

Major driver being cost, broadband penetration, advanced feature, net neutrality, customers prefer using OTT services for messaging than the traditional SMS and MMS services. OTT messaging service providers have also offered a bouquet of innovative features and services to customers due to fast IP network technologies. Some of these features include voice messages, media sharing, microblogging, Stickers, emoticons etc. Telco messaging services on the other hand have practically remained unchanged since their inception.

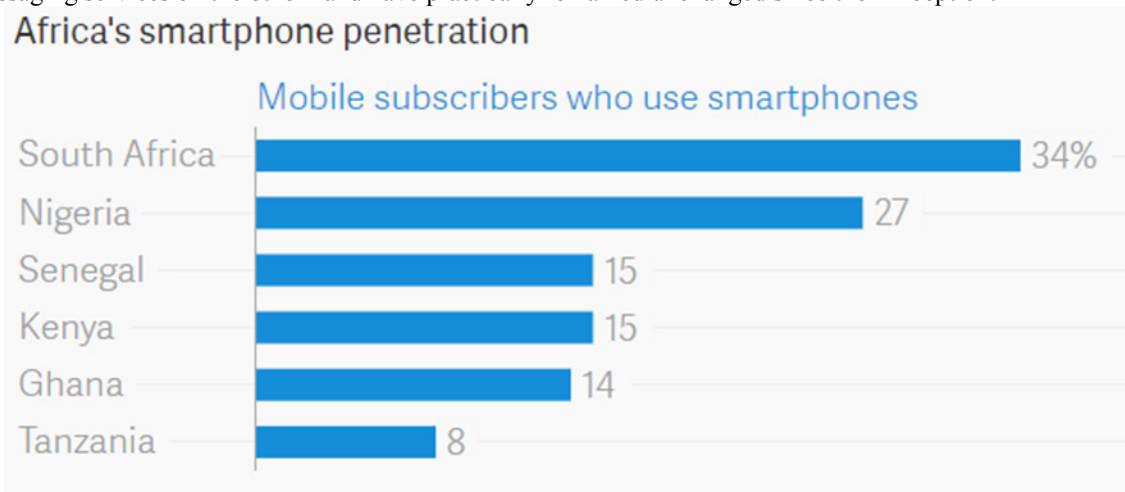


Figure 1. Smart phone's Penetration in Africa (Omar, 2016)

Table 1. Comparison between message service providers (OTT players and telecoms) (Joshi et al., 2015)

	SMS	WhatsApp	Line	WeChat	Kakao Talk	Chat ON	Viber	BBM
Text	✓	✓	✓	✓	✓	✓	✓	✓
Characters	160	None	None	None	None	None	None	None
Group Chat	×	✓	✓	✓	✓	✓	✓	✓
Emoticons	×	✓	✓	✓	✓	✓	✓	✓
Stickers	×	×	✓	✓	✓	✓	×	×
Photos	×	✓	✓	✓	✓	✓	✓	✓
Videos	×	✓	✓	✓	✓	✓	✓	✓
Audio	×	✓	✓	✓	✓	✓	×	✓
Location	×	✓	✓	✓	✓	✓	✓	×
Contact	×	✓	✓	✓	✓	✓	×	✓
Walkie-Talkie	×	✓	✓	✓	✓	×	×	×
Voice & Video Call	×	×	✓	×	×	×	✓	×
Others			Line Camera		Poll, Schedule	Animessage, File, Calendar, S Note	Doodle	Appointment

According to Naik (2012) “Net neutrality also referred to as Internet neutrality is a regulatory concept which eliminates any type of discrimination in transmission and access of content on the Internet”. It means all end users are able to access content, applications and services of their choice at the same level of service quality, Internet speed and price. “This will protect all innovators and consumers and preserve the Internet’s role as a core of free expression and democratic principles” (FCC, 2015).

The basic principle of Net neutrality proposes that networks do not discriminate between different data packets ensuring that innovators or content developers do not need to ask permission for new projects, making internet a collection of a large amount of information, analysis, opinions and services with no sole content provider or regulator. (The Economist, 2015).

The uncertain regulatory status of applications such as Voice over Internet Protocol (VoIP) and other IP-enhanced services are often cited as examples of how the current regulatory structure could stymie the deployment and development of emerging technologies.

According to Quarantini (2005) “The issue of the regulation of voice over broadband (VoB)/voice over internet protocol (VoIP) has become one of the most hotly contested in telecommunications, alongside the related issue of broadband access to the internet.

4. Challenges OTT poses to Public Switched Telephone Network (PSTN)

OTT services such as VoIP, instant messages (e.g., those provided by Skype, Viber, Whatsapp, and Facebook). These services are in direct competition with the services of telecom operators: voice, SMS, MMS, etc. Audio and video services also put heavy pressure on the volumes of data carried over the networks, requiring investment in infrastructure by the telecom operators at a level that can cope with the dramatic growth in data traffic (particularly due expanding video services).

An article written by Writer (2017) pointed that; “According to the telcos, several billions of Naira obtainable by them through voice and video calls over the mobile networks are being lost annually to these applications. “It is an aggressive approach to stop further revenue loss to OTT players on international calls, having already lost about N100tn between 2012 and 2017,” a manager at one of the major telcos in the country said. Supporting the telcos is a report from Ovum, a UK-based research and analytics company that indicated that \$386bn loss would accrue over a period of six years – between 2012 and 2018 – from Nigerian customers using the OTT voice applications.” MTN Nigeria has already complained that OTT content services have a “cannibalizing effect” on network operators’ voice and data revenue, because they provide “free” services, which duplicate those already provided by network operators such as voice calls and the SMS.

OTT applications use the telcos network infrastructure to facilitate the services but pay nothing back to the company for this. Rather, telcos in a bid to retain users, have to continue to upgrade their infrastructure. “For instance, to date, MTN has invested over \$15bn in building its network in Nigeria. You can now imagine an OTT leveraging the network to deliver its content without investing a kobo locally. The impact on revenue is

huge. Funso Aina, Public Relations and Protocol Manager, MTN Nigeria said, according to Punch Newspapers.

According to Informa's World Cellular Revenue Forecasts 2018, global annual SMS revenues will fall down from US\$120 billion in 2013 to US\$96.7 billion by 2018, due to increasing adoption and use of Over-The-Top (OTT) messaging applications.

According to the report the overall global telco voice revenues (including fixed subscriptions) will decline from \$970.4 billion in 2012 to \$799.6 billion by 2020, at a CAGR of 2.4%. Also, as a result of VoIP by 2020 the telecom industry worldwide will see a loss of revenues approximately worth \$479 billion which accounts for 6.9% of the total revenue from voice.

Another report "Consumer OTT VoIP Outlook: 2013 to 2018" by Ovum, highlights that the OTT VoIP market is growing at a rate of 20 percent. Its application's usage will reach 1.7 trillion minutes by 2018, which translates to \$63 billion in lost revenue. According to this study, as a result of increasing demand of online applications for messaging, as at year 2016, telecom operators lost revenue worth \$54 billion in messaging services.

The figure below shows telecom operators messaging and call loss to OTT services.

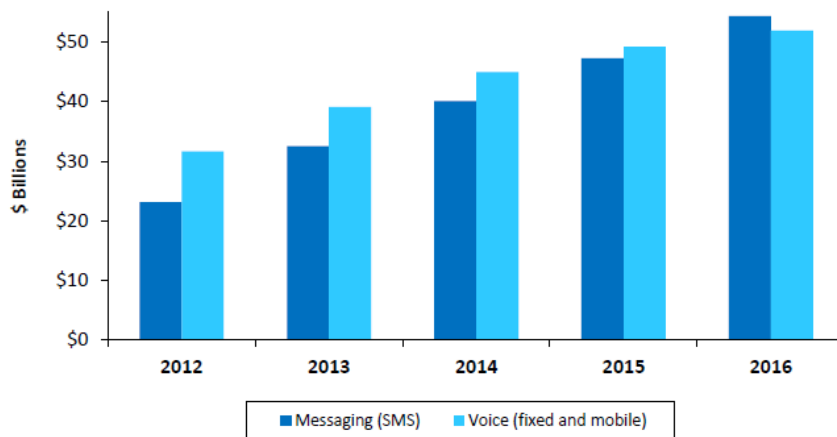


Figure 2: Worldwide operator voice and messaging revenue lost to OTT applications (Dargue & Wadsworth, 2016)

The impact of OTT players is not just limited to telcos voice and messaging services but has led to an exponential increase in their data traffic causing severe congestion problems in their telecom network. A major contributor to the increased data traffic is the growing consumer appetite for more video.

According to "Cisco Visual Networking Index: Mobile Data and Internet Traffic, 2013–2018"¹⁰, in the years between 2013 and 2018, mobile data traffic is expected to rise at a compounded annual growth rate of 61%. It is expected to grow from 1.5 exabytes to 15.9 exabytes per month by end of the year 2018.

However, according to Simon Landsheer, CEO of Silver-street "The telecom operators benefit due to rise in the data traffic as a result of increasing number of people using smartphones for OTT services, not only from increasing SMS traffic but also from increased data traffic as more smartphone users embark to OTT services". The above argument is further corroborated by the fact that for China mobile in the year 2012, SMS revenue decreased but the data traffic during the same period increased at an extraordinary rate of 187% because of the large-scale uptake of OTT services². The viral nature of OTT communication services dramatically increases the total data consumption of the consumer. Impact of OTT is not just in theory but is getting reflected in operator's financial statements as well. China Mobile, world's largest operator, has shown drastic decline in its profit for the first quarter of 2014. Its profit fell by 9.4% to its lowest point in five years, blaming OTT services for the same.

5. Threats OTT poses to National Security

Regulatory bodies say that there is a heightened security risk like identity theft and communication interception as a result of the lack of oversight in OTT services.

Though a few countries have tried to criminalize VoIP and some other OTT services, these OTT services are generally legal. They could be seen as 'bypassing' the network provider, but the customer does not think like that. That's why they are described as 'over the top'.

Here's an illustration "If I have Viber installed on my handset, and you have it on yours, then nobody is misled about what is happening. We both pay our bills to a telco that provides us with limited or unlimited data usage. We know that if we talk to each other, this is going over the top of the data network. So nobody is cheating anybody, and no customer is being misled (Priezkalns, 2015).

Law enforcement agencies in the country probably will not know how the call originated, and even if they

do, the OTT service is legal whether handling national or international communications. OTT bypass might also pose a problem for law enforcement where they have the technology to perform surveillance on traditional calls, but not on OTT communications.

It is important to note that while there are presently no concrete laws or regulations for the enforcement of Net neutrality, Internet access is generally unrestricted across the world except in a few countries where their governments impose specific restrictions in such jurisdictions (Naik, 2012).

According to Kuhn, et.al. (2005) “OTT services –like the VoIP- like many new technologies, introduces both security risks and opportunities. It has a very different architecture than traditional circuit-based telephony, and these differences result in significant security issues”. The fact that OTT service delivery relies on Internet connection makes it is just as susceptible to glitches confronted by computers.

Kuhn, et.al. (2005) also pointed that; due to the nature of the delivery of OTT services (i.e. packets are sent via the internet directly), “attackers may be able to perform activities such as intercepting communications, eavesdropping, taking control of phones, making fraudulent calls from an account, conducting effective phishing attacks by manipulating one’s caller ID, and causing service to crash”. (McDowell, US-Cert, 2010). The services are susceptible to attacks like the Denial of Service (DOS), Man in the Middle attack, build up call attack, data redirecting and SPAM over Internet telephony attack. (Rezac & Voznak, 2010).

OTT players are aware of these security challenges and thus, they are making every effort to make this fast-growing technology more secure. This made key players like Whatsapp develop an end to end encryption protocol so as to allay the security concerns of customers and challenges facing OTT services/applications.

This encryption makes packets delivered by OTT applications especially WhatsApp difficult to hijack and thus, criminals and terrorists can leverage this platform to carry out their misdeeds.

A report that was written by Linda (2017) stated that “British security officials have revealed that Westminster Bridge terror attacker Khalid Masood made series of encrypted messages on the popular messaging platform, Whatsapp, before carrying out the attack”. This attack made a security personnel lose his life. This attack is a clear example of the danger OTT services pose to national threats.

Although the British Security requested that OTT players make their back-end encryption accessible to security agencies, these OTT players see the move as very unlikely because doing so will violate the net neutrality principle and it is seen as a violation of customers confidentiality and privacy.

“According to Rudd, if there is no change in the system, terrorists would be able to communicate with each other without fear of being overheard even in cases where a legal warrant has been obtained” (Linda, 2017).

6. Conclusion

Using the Internet, calls travel as packets of data on shared lines. The uptake of new modes of communication through the voice over internet protocol (VoIP) indeed pose a threat to the survival of the more traditional telephone network technologies as these services avoid the tolls of the PSTN and are offered to the subscribers for free or at very low costs. However, it is appreciated that the traditional telephone networks had made huge investments and the voice services were a dominant business for them, the evolution of technology cannot be stopped. “Technology can be disruptive and operators have to adapt their business models or perish” (Ruiz & Lohr, 2015). The proliferation of the adoption of OTT services & applications have been identified to the following features; cost, content availability, convenience, smartphone and mobile internet penetration, user experience, features, net neutrality.

The wide adoption of OTT services has made it usable for all and sundry that has access to smartphones & can access the internet even terrorists. The inability to regulate these services makes OTT applications and services great avenues to perpetrate crime.

Terrorism is seen as one of the major security threats facing the nation and having a regulatory body that will look into the regulation of OTT services and its applications can be very instrumental in curbing crimes by monitoring activities carried out with OTT services.

7. Acknowledgement

We want to acknowledge God almighty for seeing us through this research work. We also want to acknowledge and appreciate Babcock University most especially the School of Computing and Engineering Sciences.

References

- Dargue M. & Wadsworth W. (2016). Over the Top. Operator Threat and Opportunity. The management network group inc.
- Ehijeagbon O. (2003). NCC, Telecommunications & Tariffs Regulations. Retrieved from <http://www.oseroghoassociates.com/articles/122-ncc-telecommunications-tariffs-regulations>.
- Global revenue assurance services 2013 by EY. Available on: [http://www.ey.com/Publication/vwLUAssets/Global_telecoms_revenue_assurance_survey_2013/\\$FILE/Gl](http://www.ey.com/Publication/vwLUAssets/Global_telecoms_revenue_assurance_survey_2013/$FILE/Gl)

- obal_revenue_assurance_survey_2013.pdf
- Joshi S., Sarkar S., Dewan T., Dharmani C., Purohit S. & Gandhi S. (2015). Impact of Over the Top (OTT) services on Telecom Service Providers. *Indian Journal of Science and Technology (IJST)*. 8(54), 145-160. Doi:10.17485/ijst/2015/v8i54/62238.
- Kazeem Y. (2016, February 17). Now it's Nigeria's authorities who wants to regulate apps like Whatsapp and Facebook. Retrieved from <https://qz.com/617451/now-its-nigerias-authorities-who-want-to-regulate-apps-like-whatsapp-and-facebook/>.
- Linda I. (2017, March 27). London Attacker Used Whatsapp. Retrieved from <http://www.lindaikajisblog.com/2017/03/london-attacker-used-whatsapp-company.html?m=1>.
- National Telecommunication Information Administration. (1997, April 1). *Telecommunications: Glossary of Telecommunications Terms*.
- Nigerian Communications Commission (NCC) (2016). An overview of Provision of over the Top Services. Retrieved from www.ncc.gov.ng/documents/713-overview-of-provision-of-over...top...services/file.
- Omar M. (2016). Africa's smartphone penetration. Retrieved from <https://www.theatlas.com/charts/Ey9R9Inc>.
- Patel, N. (2007) IP Telephony: Retrieved from <http://telephony-ip.blogspot.com/ng/>.
- Philippe P., Victor M. (2016). Challenges and Impacts created by Over the Top Players. In the African Telecommunication sector. A wavestone whitepaper. Retrieved from https://www.wavestone.com/app/uploads/2016/09/OTT_UK.pdf.
- Priezkalns E. (2015, August 24). The Rise of OTT bypass. Retrieved from <https://commsrisk.com/the-rise-of-ott-bypass-and-what-to-do-about-it/>.
- Rezac F., Voznak M. (2010). Security Risks in IP Telephony. *Information and Communication Technologies and Services*. 8(1). ISSN 1804-3119.
- Ruiz, R.R. & Lohr, S. (2015). FCC Approves Net Neutrality Rules, Classifying Broadband Internet Service as a Utility. *The New York Times*.
- Sahil P. (2015, July 7). WTF is OTT. *Digiday*. Retrieved from <https://digiday.com/media/what-is-over-the-top-ott/>.
- Udoh N. (2016, February 19). Nigerian Authority to regulate over-the-top services in the country. Retrieved from https://www.wavestone.com/app/uploads/2016/09/OTT_UK.pdf.
- Writer S. (2017, February 20). Why Telcos want Skype and Whatsapp calls banned (Nigeria). Retrieved from <https://asokoinsight.com/news/why-telcos-want-skype-and-whatsapp-calls-banned-nigeria>.