UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INVESTIGATING CHALLENGES AND REQUIREMENTS FOR FTTH DEPLOYMENT IN IRAQ ENVIRONMENT: MOSUL CASE STUDY

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MASTER OF COMPUTER SCIENCE (INTERNETWORKING TECHNOLOGY)

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Faculty of Information and Communication Technology

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A thesis submitted
in fulfillment of requirements for the degree of Master of Computer Science
(Internetworking Technology)

Faculty of Information and Communication Technology

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2014

DECLARATION

I declare that this thesis entitled “Investigating Challenges and Requirements for FTTH Deployment in Iraq Environment: Mosul Case Study” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……

Name : Mahmood Muayad Mohammed

Date : ……

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree Master of Computer Science (Internetworking Technology).

Signature :……

Supervisor Name :……

Date :……

DEDICATION

قال تعالى في محكم كتابه الكريم

وَقُلِ اعْمَلُواْ فَسَيَرَى اللّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

صدق الله العلي العظيم

الاية ١٠٥سورة التوبة

To who Allah give him prestige and dignity... To those who taught me tender without waiting... to those who carry his name proudly... I ask God to give you at your age to see the fruit is ripe for the picking after a long wait and will remain your star guided his day and tomorrow and forever.

My dear father ..... Expert Muayad Mohammed Mahmood Al-Khayyat

To my angel in life… To the meaning of love and the meaning of compassion and dedication… Smile to life and the mystery of existence…

To those who were her praying is the secret of my success and her affection is the heart balm to the most love one.

My beloved mother ..... Engineered Hanaa Ibrahim Daud Al-Khafaf

To who make me older and I rely upon .. burning candle to illuminate the darkness of my life …To whom her existence is my gained strength and her love has no limits ..

To know from them the meaning of life.

Sisters ..... Omo Anas , Omo Mohammed and Omo Sarah

To my sisters and my way mates, and this life is nothing without you, and I am with you and without you like anything... At the end of my career I want to thank you for your positions to the noble looked to my success with hope.

Mahmood Muayad Mohammed

اهداء

قال تعالى في محكم كتابه الكريم

وَقُلِ اعْمَلُواْ فَسَيَرَى اللّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

صدق الله العلي العظيم

الاية ١٠٥سورة التوبة

إلهي لايطيب الليل إلا بشكرك ولايطيب النهار إلى بطاعتك .. ولاتطيب اللحظات إلا بذكرك .. ولا تطيب الآخرة إلا بعفوك .. ولا تطيب الجنة إلا برؤيتك
الله جل جلاله.

إلى من بلغ الرسالة وأدى الأمانة .. ونصح الأمة .. إلى نبي الرحمة ونور العالمين ..
سيدنا محمد صلى الله عليه وسلم
إلى من كلله الله بالهيبة والوقار .. إلى من علمني العطاء بدون انتظار .. إلى من أحمل أسمه بكل افتخار ..
أرجو من الله أن يمد في عمرك لترى ثماراً قد حان قطافها بعد طول انتظار وستبقى كلماتك نجوم أهتدي بها اليوم وفي الغد وإلى الأبد ..

والدي العزيز..... الخبير مؤيد محمد محمود الخياط
إلى ملاكي في الحياة .. إلى معنى الحب وإلى معنى الحنان والتفاني .. إلى بسمة الحياة وسر الوجود
إلى من كان دعاءه سر نجاحي وحنانه بلسم جراحي إلى أغلى الحبايب

أمي الحبيبة ..... المهندسة هناء ابراهيم داؤود الخفاف
إلى من بها أكبر وعليها أعتمد .. إلى شمعة متقدة تنير ظلمة حياتي ..
إلى من بوجودها أكتسب قوة ومحبة لا حدود لها ..
إلى من عرفت معها معنى الحياة

أخواتي ..... ام محمد و ام انس و ام سارة
إلى اخواتي ورفيقات دربي وهذه الحياة بدونكم لاشيء معكم أكون أنا وبدونكم أكون مثل أي شيء .. في نهاية مشواري أريد أن أشكركم على مواقفكم النبيلة إلى من تطلعوا لنجاحي بنظرات الأمل ....

محمود مؤيد محمد

DEDICATION

Special Thanks:

My thanks also to all who did not stand on our side, and stand in our ways and blocked the march of our research, and the laying of the thorns in the way of our search Without the presence of what we felt the pleasure of the search, and the sweetness of positive competition, and without whom what we got to where we are they have us all thanks.

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اهداء

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محمود مؤيد محمد

ABSTRACT

Fiber-To-The-Home (FTTH) is the most promising technology that can offer high bandwidth with more reliability and very high Quality of Service (QoS) comparing with the previous kinds of traditional internet connection technologies such as DSL. This technology is based on the optical technology, which uses fiber optics that connect the internet service to the end-user which is the subscriber. Our work is done for the sake of investigation the factors and challenges that required for deploying FTTH technology or a suitable architecture in Iraq. There will be challenges and issues that could be faced while implementing a certain type of FTTH architecture. In this case, the increasing of requesting a higher bandwidth access makes us really think about what is the best solution to provide as an internet access to the end-user in Iraq that supports higher capacity adaptability. The results of this work will be helpful for the government and companies that provide the internet access to the end-users in Iraq to deploy this technology successfully. Firstly, we will investigate the current studies and works to have enough knowledge about FTTH. Then we need to identify the factors that will affect the successful deployment by surveying the users in Mosul to generate the factors by performing the analysis part on the collected data to help proposing and choosing the suitable FTTH architecture in the end.

ABSTRAK

Fiber-Ke-Rumah (FKR) adalah teknologi yang memberi jaminan dan menawarkan lebar jalur berkapasiti tinggi yang boleh dipercayai dan memberikan kualiti perkhidmatan yang baik dibandingkan dengan menggunakan internet secara tradisional seperti DSL. Teknologi ini berdasarkan kepada teknologi optik yang menggunakan optik fiber yang menghubungkan perkhidmatan internet kepada pengguna-pengguna iaitu pelanggan. Kerja kami telah terlaksana dengan menyiasat faktor-faktor dan cabaran-cabaran yang diperlukan untuk menyediakan teknologi FKR dan juga senibina yang sesuai untuk persekitaran di Iraq. Terdapat cabaran-cabaran dan isu-isu yang mungkin dihadapi untuk melaksanakan senibina FKR. Pada kes ini, pertambahan kepada permintaan jalur lebar yang lebih tinggi membuatkan kami memikirkan apakah penyelesaian terbaik untuk menyediakan kemudahan capaian internet kepada pengguna-pengguna di Irak yang menyokong kapasiti yang tinggi dalam penyesuaian. Keputusan pada kajian ini akan menjadi begitu berguna kepada kerajaan dan syarikat-syarikat yang menyediakan capaian internet kepada penduduk Iraq dan memasang teknologi ini secara berjaya. Pertamanya, kami akan menyiasat kajian-kajian dan kerja-kerja terkini untuk mendapatkan cukup pengetahuan tentang FKR. Kemudian, kami telah mengenalpasti faktor-faktor yang mempengaruhi kejayaan pemasangan dengan melakukan kaji selidik di daerah Mosul untuk mendapatkan faktor dengan melaksanakan analisis pada data yang diperolehi dari kaji selidik untuk membantu mencadangkan dan memilih senibina FKR yang sesuai sebagai hasil kajian ini.

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Mahmood Muayad Mohammed

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AON: Active Optical Network.

ATM: Asynchronous Transfer Mode.

BPON: Broadband Passive Optical Network.

CCI: Communications Content and Infrastructure.

CO: Central Office.

CTMC: Central Tube Mini Cable.

DSL: Digital Subscriber Line.

EPFU: Enhanced Performance Fiber Units.

EPON: Ethernet Passive Optical Network.

EPP: Entry Point Project.

FCPC: Fiber Connector Physical Connection.

FTTB: Fiber to the Building.

FTTC: Fiber to the Curb / Cabinet.

FTTH: Fiber to the Home.

FTTN: Fiber to the node.

Gbps: Gigabit per second.

GPON: Gigabit-capable Passive Optical Network.

HD: High Definition.

HFC: Hybrid Fiber Coaxial.

ICT: Information and Communication Technology.

ILD: Injection Laser Diode.

ISP: Internet Service Provider.

ITU: International Telecommunication Union.

LAN: Local Area Network.

LED: Light Emitting Diodes.

LTC: Loose Tube Cables.

LTMC: Loose Tube Mini Cable.

Mbps: Megabit per second.

MOOSE: Multi-level Origin-Organized Scalable Ethernet.

MuC: Micro-Cable.

OLT: Optical Line Terminal.

ONT: Optical Network Termination.

OTDR: Optical Time Domain Reflect meter.

P2MP: Point-to-multipoint.

P2P: Point-to-point.

PON: Passive active network.

PTS: Swedish Post and Telecom Authority.

QoS: Quality of Service.

VDSL: Very High Bit Rate Digital Subscriber Line.

Wi-Fi: Wireless Fidelity.

WLAN: Wireless Local Area Network.

CHAPTER 1

INTRODUCTION

1.0 Background

The first chapter objective is to show the proposed idea overview in details to give a clear picture about what we can get while doing this research therefore there is a sub-titles that provide the details for each sub-title, respectively.

1.1 Introduction

Internet technologies are very necessary nowadays because our life's dependent on the digital technologies that involved approximately all the activities that human do such as connecting to bank accounts, watching YouTube, Facebook, Google's services, online shopping, and video calling. In addition, Information and Communication Technology (ICT) has a huge impact on the society economics.

Subscribers to internet technologies around the globe highly need and request for a better internet line service in terms of providing high bandwidth and better reliability. They desired more speed and much more stable connection which DSL and Wi-Fi cannot provide. In this case, Fiber optic cables are the solution for this case which can provide high bandwidth with high throughput and low attenuation. Fiber optic cables are based on the light technology that carry the data in a light form, so the transmission of the data is