



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

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**MASTER OF COMPUTER SCIENCE
(INTERNETWORKING TECHNOLOGY)**

2014



Faculty of Information and Communication Technology

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MAHMOOD MUAYAD MOHAMMED

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

Faculty of Information and Communication Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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

وَقُلْ اَعْمَلُوا فَسَيَرَى اللّٰهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

صدق الله العلي العظيم

الاية ١٠٥ سورة النوبة

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 اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

صدق الله العلي العظيم

الاية ٥٠-سورة التوبة

إلهي لا يطيب الليل إلا بشكرك ولا يطيب النهار إلا بطاعتك .. ولا تطيب 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 بالهبة 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 أهدي 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 بسمه الحياة وسر الوجود
إلى من كان دعاءه سر نجاحي وحنانه بلسم جراحي إلى أعلى الحباب

أمي الحبيبة المهندسة هناء إبراهيم 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 ورفيقاتي 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.

Mahmood Muayad Mohammed

اهداء

شكر خاص:-

اتوجه بالشكر أيضا إلى كل من لم يقف إلى جانبنا ، ومن وقف في طرقنا وعرقل مسيرة بحثنا، وزرع الشوك في طريق بحثنا فلولا وجودهم لما أحسسنا بمتعة البحث ، ولا حلاوة المنافسة الإيجابية، ولولاهم لما وصلنا إلى ما وصلنا إليه فلهم منا كل الشكر.....

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 Iraq 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.

ACKNOWLEDGEMENTS

First and foremost, praise be to Allah, for giving me this opportunity, the strength and the patience to complete my thesis finally, after all the challenges and difficulties. I would like to thank my supervisor, Dr. Abdul Samad Bin Shibghatullah for his high motivation and most significant contribution in this thesis.

I would also like to thank Ministry of Higher Education and Scientific Research of IRAQ, all UTeM staff and Malaysian people and Assoc. Prof. Dr. Burairah Bin Hussin and Dr. Mohd Sanusi bin Azmi. Furthermore, I want to thank my friends who have helped and motivated me throughout. May Allah reward them all abundantly, Sincere thanks to all.

Mahmood Muayad Mohammed

TABLE OF CONTENTS

	PAGE
DECLARATION	
DEDICATION	
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF EQUATIONS	xii
LIST OF ABBREVIATIONS	xiii
CHAPTER 1	1
1 INTRODUCTION	1
1.0 Background	1
1.1 Introduction	1
1.2 Research background	2
1.3 Research Problem	3
1.4 Research Questions	4
1.5 Research Objectives	5
1.6 Research Scope	5
1.7 Research Significance	6
1.8 Thesis organization	7
1.9 Summary	8
CHAPTER 2	9
2 LITERATURE REVIEW	9
2.0 Background	9
2.1 Introduction	9
2.2 Fiber optics	10
2.2.1 Single-Mode fiber	10
2.2.2 Multi-Mode fiber	11

2.3	Fiber optic products	11
2.3.1	Enhanced Performance Fiber Units (EPFU)	12
2.3.2	Micro-Cable (MuC)	13
2.3.3	Mini-Cables	14
2.3.4	Loose Tube Cables (LTC)	15
2.4	Fiber cables advantages compared to copper cables	15
2.5	Fiber optics disadvantages	16
2.6	Optical Access Network architectures	17
2.6.1	Fiber to the node (FTTN)	18
2.6.2	Fiber to the curb (FTTC)	18
2.6.3	Fiber to the building (FTTB)	19
2.6.4	Fiber to the home (FTTH)	19
2.7	Technical view of Various Broadband Technologies	20
2.8	FTTH Topologies	22
2.8.1	Point to Point (P2P) topology	22
2.8.2	Point to Multipoint (P2MP) topology	23
2.9	Two major network solutions	23
2.9.1	Active Optical Network (AON)	23
2.9.2	Passive Optical Network (PON)	24
2.10	PON generations and history	25
2.10.1	BPON	26
2.10.2	EPON	26
2.10.3	GPON	27
2.11	PON Components and equipment	27
2.11.1	Optical Line Terminal (OLT)	27
2.11.2	Optical Network Terminal (ONT)	28
2.11.3	Optical Splitters	28
2.12	What are the reasons that support FTTH deployment	29
2.12.1	Customer benefits	30
2.12.2	Operator's benefits	31
2.12.3	Company's benefits	32
2.12.4	Public Bodies and government benefits	32
2.12.5	Environment and Society benefits	33

2.12.6	Socio-economic benefits	33
2.13	Reviewing FTTH deployment in three different countries	34
2.13.1	Sweden	34
2.13.2	Canada	35
2.13.3	Malaysia	36
2.14	Summary	38
CHAPTER 3		40
3	METHODOLOGY	40
3.0	Introduction	40
3.1	Proposed Methodology for this research	40
3.1.1	Construct a literature review	42
3.1.2	Identify the problem dimensions	42
3.1.3	Determine where and which data to collect	43
3.1.4	Performing analysis on the collected data	43
3.1.5	Proposing a network architecture	44
3.1.6	Provide limitations, conclusion, and future work	45
3.2	Summary	46
CHAPTER 4		47
4	SURVEYING THE SUCCESSFUL KEY FACTORS	47
4.0	Introduction	47
4.1	Data collection	47
4.1.1	Using Google document to design the survey	48
4.2	Survey design	50
4.3	Responses data gathering	53
4.4	Analyzing the users responds	54
4.4.1	Part 1 (Personal information) analysis	55
4.4.2	Part 2 (The current internet service) analysis	60
4.4.3	Part 3 (Proposed FTTH internet service) analysis	71
4.5	Summary	76
CHAPTER 5		77
5	PROPOSING NETWORK ARCHITECTURE FOR MOSUL AND EVALUATION	77
5.0	Introduction	77
5.1	Proposing the Architecture	77

5.2	Evaluation of the architecture	84
5.2.1	Scalability	84
5.2.2	Usability	84
5.2.3	Bandwidth	85
5.2.4	Maintenance	85
5.2.5	Cost	86
5.3	Summary	87
CHAPTER 6		88
6	CONCLUSION AND FUTURE WORK	88
6.0	Introduction	88
6.1	Problems and Limitations	89
6.2	Future work	90
6.3	Summary	91
REFERENCES		92
APPENDIX A		98
APPENDIX B		104

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1:	Types of fiber optic cable products.	12
Table 2.2:	PONs generations details.	25
Table 2.3:	Comparing between three internet subscription types using downloading speed.	31
Table 2.4:	Summary of some important papers in the literature review.	38

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1:	Kinds of FTTH based on independent locations (Rigby 2011).	3
Figure 1.2:	The needed bandwidth from 2010 to 2030 measured in Mbps (BroadbandCommunities 2013).	4
Figure 2.1:	Single-Mode fiber optic components.	10
Figure 2.2:	differences between the two fiber types.	11
Figure 2.3:	Picture of the four products of fiber cables.	12
Figure 2.4:	EPFU with 8 core fibers.	13
Figure 2.5:	Micro-Cable fiber.	13
Figure 2.6:	Central Tube Mini Cable structure.	14
Figure 2.7:	Loose Tube Mini Cable structure.	14
Figure 2.8:	Loose Tube Cables structure.	15
Figure 2.9:	FTTx classification based on the distance (Scott 2010).	17
Figure 2.10:	FTTC architecture (Rigby 2011).	19
Figure 2.11:	FTTB architecture (Rigby 2011).	19
Figure 2.12:	FTTH architecture (Rigby 2011).	20
Figure 2.13:	The FTTH various access network methods speed.	21
Figure 2.14:	P2P topology.	22
Figure 2.15:	P2MP topology.	23

Figure 2.16: Basic PON solution.	24
Figure 2.17: history of the PON generations.	26
Figure 2.18: Directions of downstream and upstream traffic signals.	28
Figure 2.19: The optical splitter operation.	29
Figure 2.20: Effects of FTTH Deployment on different aspects of society.	30
Figure 2.21: Trend of fixed broadband subscribers in Sweden country (Davidsson et al. 2012).	35
Figure 2.22: Trend of fixed broadband subscription in Canada (Saeed 2011).	36
Figure 2.23: FTTH access network six features offered in Malaysia.	37
Figure 3.1: Proposed methodology for this research.	41
Figure 3.2: Method strategy of our survey.	44
Figure 4.1: Sign in to google account.	48
Figure 4.2: Google Drive location.	49
Figure 4.3: Google Drive documents.	49
Figure 4.4: Google form design mode screenshot.	50
Figure 4.5: A screenshot of the survey questionnaire final design.	51
Figure 4.6: How the data look like after the collection completes.	54
Figure 4.7: Gender count.	55
Figure 4.8: Age count.	56
Figure 4.9: Area count.	56
Figure 4.10: Educational levels count.	57
Figure 4.11: Users salary count.	58
Figure 4.12: Number of family members count.	59
Figure 4.13: Living place type count.	60
Figure 4.14: Internet subscription type count.	61

Figure 4.15: Service provider companies count.	61
Figure 4.16: Current internet service speed count.	62
Figure 4.17: Number of users share the same internet line.	63
Figure 4.18: Type of devices that are connected.	64
Figure 4.19: Current usage of the internet line.	65
Figure 4.20: Frequency of the connecting times.	66
Figure 4.21: Current user skills levels.	67
Figure 4.22: Current internet speed levels.	67
Figure 4.23: Current service payment levels.	68
Figure 4.24: The experience with the current internet companies levels.	69
Figure 4.25: Desired usage factors of the internet line.	70
Figure 4.26: Current internet issue in user's opinion.	71
Figure 4.27: User acceptance for the new service.	72
Figure 4.28: Choosing the connection method.	73
Figure 4.29: Choosing the type of the service.	74
Figure 4.30: New internet service selected speed by the users.	75
Figure 5.1: Mosul left coast area.	78
Figure 5.2: Our proposed architecture chart.	79
Figure 5.3: Proposed FTTN architecture.	80
Figure 5.4: Mosul area calculation.	81
Figure 5.5: Left coast of Mosul area.	82
Figure 5.6: FCPC connector type for single mode fiber cable.	83

LIST OF EQUATIONS

EQUATION	TITLE	PAGE
Equation 5.1:	Calculating the number of needed cabinets.	80

LIST OF ABBREVIATIONS

- 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