

# INTEGRATION OF FOURTH GENERATION WITH HETEROGENEOUS NETWORKS

اندماج أنظمة الجيل الرابع مع الشبكات الغير متجانسة

A Thesis Submitted As Partial Fulfillment Of The Requirement For The Degree Of  
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# Dedication

This work is dedicated to:

My parents

Brothers

Sisters

Relatives

Friends

And Colleagues.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَإِذْ قَالَ رَبُّكَ لِلْمَلَائِكَةِ إِنِّي جَاعِلٌ فِي الْأَرْضِ خَلِيفَةً ۖ فَاذْكُرُوا اللَّهَ إِذْ أَنْشَأَ آدَمَ ۖ وَكُنْ عَلَيْهِ كَارِهُينَ ۚ فَلَمَّا أَنْشَأَ آدَمَ قَالَ رَبُّكَ اصْبِرْ عَلَىٰ مَا يَنْفَخُ فِيكَ مِنَ الْمَلَائِكَةِ فَقَالَ أَنبِئُونِي بِأَسْمَاءِ هَٰؤُلَاءِ إِنْ كُنْتُمْ صَادِقِينَ ﴿٣١﴾ قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا بِمَا عَلَّمْتَنَا ۖ إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ ﴿٣٢﴾ يَا آدَمُ أَنْبِئْهُمْ بِأَسْمَاءِهِمْ ۖ فَلَمَّا أَنْبَأَهُمْ بِأَسْمَائِهِمْ قَالَ أَلَمْ أَقُلْ لَّكُمْ إِنِّي أَعْلَمُ غَيْبَ السَّمَاوَاتِ وَالْأَرْضِ وَأَعْلَمُ مَا تُبْجُونَ وَمَا كُنْتُمْ تَكْتُمُونَ ﴿٣٣﴾

صدق الله العظيم

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## ABSTRACT

The rapidly growing demand for “anywhere, anytime” high-speed access to IP-based services is becoming one of the major challenges for mobile networks. As the demand for mobility increases, mobile terminals need to move freely across heterogeneous networks, posing the challenge of network integration into an All-IP access platform.

The objective of this research is to discuss the possible integration techniques to integrate wireless heterogeneous networks and also to clarify the reasons of selecting Mobile IP as a preferable integration solution. Moreover, the research illustrates the strengths points of MIPv6 over MIPv4 and proposes three integration techniques namely Lazy Cell Switching, Eager Cell Switching and Parametric Cell Switching. The handover performance was simulated using a MATLAB tool and results were studied and evaluated based on three metrics which are: 1- Handoff latency (network outage time), 2- Number of performed handoffs and 3- User value which offers the most optimal network.

## مستخلص

إن الطلب المتنامي من أجل الحصول على خدمات ولوج فائقة السرعة ومعتمدة على بروتوكول الإنترنت أصبح من التحديات الكبيرة في شبكات الجوال ، فيما أن الطلب من أجل قابلية التحرك يزيد فإن أجهزة الجوال تحتاج ان تتجول بحرية ويسر عبر الشبكات الغير متجانسة واضعا التحدي من أجل تكامل هذه الشبكات يسير الى جعلها تعتمد على وجود بنية ولوج تستخدم بروتوكول الإنترنت في كل مكان وفي جميع الأوقات .

ان الهدف من هذه البحث هو مناقشة التقنيات التي تمكن من اندماج الشبكات الغير متجانسة ولتوضيح سبب اختيار بروتوكول الإنترنت ذو النسخة السادسة كحل اندماج مفضل . اضافة الى ذلك ، فإن البحث يكشف عن نقاط تفوق بروتوكول الإنترنت ذو النسخة السادسة على الرابعة ويقترح ثلاث تقنيات اندماج وهي انتقال الخلية البطئ وانتقال الخلية المتلف وانتقال الخلية ذو الخصائص.

ان فعالية قابلية التحرك تم ايجادها عن طريق النمذجة والمحاكاة وتمت دراسة النتائج المتحصل عليها وتقييمها بناءا على ثلاثة معايير ألا وهي : ١- زمن كمون (استتار) قابلية التحرك و ٢- عدد مرات تنفيذ الانتقال بين نقطتي تغطية و ٣- جودة الخدمة التي توفر للمستخدم .

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## List of Abbreviations

AAA	Authentication, Authorization and Accounting
AMPS	American Mobile Phone System
AP	Access Point
AR	Access Router
ARP	Address Resolution Protocol
CDMA	Code Division Multiple Access
CH	Corresponding Host
CN	Correspondent Node
COA	Care Of Address
DCS	Digital Cellular System
DSSS	Direct Sequence Spread Spectrum
ECS	Eager Cell Switching
EDGE	Enhanced Data Rates for Global Evolution
FA	Foreign Agent
FDMA	Frequency Division Multiple Access
FM	Frequency Modulation
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GSM	Global System for Mobile
GTP-U	GPRS Tunnelling Protocol for UMTS
HA	Home Agent
HLR	Home Location Register
HSCSD	High-Speed Circuit Switched Data
IEEE	Institute of Electrical and Electronics Engineers
IMSI	International mobile subscriber identity
IPsec	Secure Internet Protocol
IWU	Interworking Unit
Kc	8-byte-long cipher key and results from applying the two parameters

	Ki and RAND to the algorithm A8
LAN	Local Area Network
LCS	Lazy Cell Switching
MAC	Medium Access Control Layer
MAN	Metropolitan Area Network
MIPv4	Mobile Internet Protocol version 4
MIPv6	Mobile Internet Protocol version 6
MPEG	Moving Pictures Expert Group
MS	Mobile Station
MSC	Mobile Services Switching Centre
NMT	Nordic Mobile Telephone
OFDM	Orthogonal Frequency Division Multiplexing
PCMCIA	Personal computer memory card international association
PCS	Personal Communication System
PDA	Personal Digital Assistants
PDCP	Packet Data Convergence Protocol
PDP	Packet Data Protocol
PCS	Parametric Cell Switching
PHY	Physical Layer
PS CN	Packet Switching Core Network
QoS	Quality of Service
RAND	Random Number
RNC	Radio Network Controller
RSS	Received Signal Strength
SGSN	Serving GPRS Support Node
SIM	Subscriber Identity Module
SRES	Signed Response
TACS	Total Access Communication
TDMA	Time Division Multiple Access
UMTS	Universal Mobile Telecommunication System
UTRAN	UMTS terrestrial RAN
VLR	Visitor Location Register

WAN	Wide Area Network
WCDMA	Wideband Code Division Multiple Access
WEP	Wired Equivalent Privacy
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Networks
WMAN	Wireless Metropolitan Area Networks
WPAN	Wireless Private Area Networks
WWAN	Wireless Wide Area Network
8PSK	Eight-Phase Shift Keying