الاستهلال

قال تعالى:

" إِنْ أُرِيدُ إِلاّ الإِصْلاَحَ مَا اسْتَطَعْتُ وَمَا تَوْفِيقِيَ إِلاّ بِاللّهِ عَلَيْهِ تَوَكّلْتُ وَإِلَيْهِ أُنِيبُ "

صدق الله العظيم

سورة هود

الآية (٨٨)

Dedication

To

Our Beloved mothers

To

Our fathers

To

Our brothers and Sisters

To

Our teachers & colleagues

Aknowledgement

First Alhamdulillah that with his blessing this work is fulfilled

All thanks and appreciation for our supervisor Dr.FathElrahman for his patience with us

We appreciate the countless hours and the efforts he dedicated to guide us through this thesis

Lastly we need to thank our teachers in electronic engineering school for their efforts in help and support

Abstract

Long-Term Evolution (LTE) allows operators to use new and wider spectrum and complements 3G networks with higher data rates, lower latency and a flat, IP-based architecture to deal with sudden increase in demand for mobile broadband services and to further improve the broadband user experience in a ubiquitous and cost-effective manner 3GPP has been working on various aspects of the LTE Advanced standard.

LTE-Advanced which is based on heterogeneity concept is using a mix of macro, Pico, femto and relay base-stations, thats enable flexible and low-cost deployments and provide a uniform broadband experience to users anywhere in the network.

A heterogeneous network (HetNet) with macro base stations (BSs) together with low power small cells, such as Pico BSs and femto BSs, is a promising solution to enhance network capacity. In HetNet, the transmission ranges of Pico BSs are limited due to the large transmission power difference between macro and Pico BSs, and thus Pico BSs are typically underutilized. Cell Range Expansion (CRE) is a way to increase the opportunity of the user equipment (UE) associations to Pico BSs so that more traffic from the macro cell can be offloaded to the Pico cells.

This thesis investigates using MATLAB simulation how associating more users to the Pico cells by range expansion can enhance the network performance and improve user experience (at number of users equal to 40 users) by enhancing data rate by 60%, bandwidth utilization by 22%, throughput by 17%, and spectral efficiency by 2%.

المستخلص

شبكة التطور طويل الامد تتيح للمستخدمين استخدام نطاق جديد وأوسع وتكمل تطور الجيل الثالث من شبكات المحمول وذلك بتوفير سرعات عالية ,زمن تاخير اقل وبنية برتوكول انترنت موحدة وّذلك للتعامل مع الزيادة المفاجئة في الطلب على خدمات النطاق العريض المتنقلة وزيادة تحسين تجربة المستخدم واسع النطاق بطريقة متوفرة في كل مكان وبتكاليف اقل.

التطور طويل الامد المتقدم مبني على مبدا عدم التجانس وذلك من خلال استخدام احجام مختلفة من الخلايا الاساسية (ماكرو ,بيكو, فيمتو, ميكرو) مما يوفر مرونة وتكلفة تركيب اقل ويوفر تجربة النطاق العريض بطريقة موحدة لكل المستخدمين في الشبكة في اي مكان.

الشبكة الغير متجانسة المكونة من خلية ماكرو اساسية جنبا الي جنب مع خلايا صغيرة منخفضة الطاقة، مثل خلايا البيكو الاساسية وخلايا الفيمتو الاساسية، هو حل واعد لتعزيز قدرة الشبكة.

في الشبكة الغير متجانسة نطاق ارسال خلايا البيكو الاساسية محدود وذلك نتيجة للاختلاف الكبير بين قوة الارسال بين خلايا الماكرو الاساسية وخلايا البيكو الاساسية, ونتيجة لذلك خلايا البيكو الاساسية عادة ما تكون غير مستغلة بطريقة فعالة.

توسيع نطاق الخلية هو حل فعال لزيادة فرصة انضمام مزيد من المستخدمين الي نطاق خلية البيكو الاساسية وذلك لتقليل ازدحام المستخدمين في خلية الماكرو الاساسية.

هذه الأطروحة تحقق بإستخدام برنامج المحاكاة الماتلاب في أن كيفية ربط المزيد من المستخدمين إلى خلايا البيكو عن طريق توسيع نطاق الخلية يمكن أن يعزز من أداء الشبكة وتحسين تجربة المستخدم (عند عدد مستخدمين يساوي 40 مستخدم) من خلال تعزيز معدل البيانات بنسبة 60%, الاستخدام الفعال للنطاق بنسبة22%, انتاجية الشبكة بنسبة 17%, والكفاءة الطيفية بنسبة 2%.

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LIST OF ABBRIVIATIONS

1G	First Generation
2G	Second Generation
3G	Third Generation
3GPP	The Third Generation Partnership Project
4G	Fourth Generation
ABS	Almost Blank Sub
BTs	Base Stations
CCs	Component Carriers
CDF	Cumulative Distribution Function
CPE	Customer Premises Equipment
CRE	Cell Range Expansion
CSG	Closed Subscriber Group
CoMP	Coordinated Multi Point
Cisco	Computer Information System of Center Operation
DL	Downlink

ICIC	Inter-Cell Interference Coordination
ER	Expanded Region
FSPL	Free-Space Path Loss
GSM	Global System for Mobile Communication
HCNs	Heterogeneous Cellular Networks
HeNB	Home enhanced Node-B
HetNet	Heterogonous Network
HSPA	High Speed Packet Access
IMT	International Mobile Telecommunications
IT	Information Technology
ICIC	Inter-Cell Interference Coordination
ITU	International Telecommunication Union
LPNs	Low Power Nodes

LTE	Long Term Evaluation
MatLab	Matrix Laboratory
MBS	Macro Base Station
MIMO	Multiple Input Multiple Output
O&M	Operations and Maintenance
OS	Operating System
PPP	Poisson Point Process
PBS	Pico Base Station
QoE	Quality of Experience
QoS	Quality of Service
REB	Range Expansion Bias
RF	Radio Frequency
RP	Resource Partitioning

RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSS	Reference Signal Strength
SINR	Signal to Interference to Noise Ratio
SE	Spectral Efficiency
SOC	System On a Chip
SON	Self-Optimizing Network
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
Wi-Fi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access