International Journal of Innovations & Advancement in Computer Science
IJIACS
ISSN 2347 – 8616
Volume 4, Special Issue
March 2015

Academic Science

A survey on Real-Time Traffic Monitoring & Dynamic Profile Management in Mobile Data Networks

Priyanka Gupta
Student
PDM College of Engineering & Technology, B'Garh
Ajay Dureja
Assistant Professor
PDM College of Engineering & Technology, B'Garh

ABSTRACT

The purpose of this paper is to carry out study on techniques which are involve in real time traffic monitoring that deals with handling network load or congestion and to manage user profile dynamically in mobile data networks. Various algorithms as defined and used in the study of previous investigators have been reviewed and analyzed and a tabulated summary work have been carried out. In this paper, the focus will be more on providing better Quality of service (QoS) by using dynamic profile management that ensures user Quality of Experience (QoE) for a particular subscription and service type. It will covers how the congestion impacts QoE and how operators can use the standard QoS and policy management to ease network congestion and provide higher service quality. Avoiding network congestion or load balancing is not in the scope of this paper rather to provide better QoS and QoE when there is congestion in the network.

Keywords: Dynamic Profile Management, QoS, QoE, Real Time Traffic, congestion, etc

1. INTRODUCTION

1.1 Mobile Broadband Network will get congested time to time as the network traffic increases during peak hour and it affected End user's Quality of Service (QoS). Today's Networks are expected to provide High Quality of Service at any cost and it is the top most concerned area of all mobile operators. Bringing new hardware or over provisioning network is not feasible and preferred solution in meeting Service Level Agreements (SLAs) as contracted by the providers. Since networks resources are limited, expensive and shared among various users and services, a positive end user quality of service can be obtained by efficient utilization of available network resources, adapting bandwidth allocation and management of user profile dynamically.

1.2 Real time traffic monitoring involves recording and analysis of network traffic in real time. Network traffic can be analyzed based on network capacity and congestion load.

1.3 Dynamic Profile management will play an important role in improving QoS in mobile broadband networks. User's Profile will get manage dynamically when there is congestion in the network. Network will be monitored continuously to check for any network congestion.

Academic Science

Dynamic Profile management is the process of applying operator-defined policy rules for network use and resource allocation. It includes policy or Profile enforcement processes. Profile enforcement involves detection of service data flow, analysis of network traffic and applies QoS (policy) rules to individual service data flows.
Dynamic Profile management is critical in following three closely-related areas:
Limiting network congestion
Enhancing service quality
Monetizing services

2. RELATED WORK

2.1 Force-based Load Balancing in co-located UMTS/GSM Networks.

Andreas Pillekeit, Fariborz Derakhshan, Enrico Jugl, & Andreas Mitschele-Thiel focuses on intelligent algorithms to decide the balancing of the load between the different radio technologies. The algorithm used in their paper was based on the approach previously employed to balance the load of distributed computing systems. They have used simulation tool for the evaluation of algorithm in mobile networks that uses simulation parameters. Force based CRRM algorithm was being used that proved very robust with respect to changes of the parameters. The solution was connected mode based [1].

2.2 Traffic Steering and Service Continuity in GSM-WCDMA Seamless networks

D. Truina & A. Furuskar have worked on GSM-WCDMA networks and focuses on how best GSM & WCDMA take advantage of each other. Handover between 2G & 3G networks requires efficient mechanisms for traffic management between them and support for service continuity at the time of system changeover. They have targeted voice service for service continuity and introduce load balancing solutions based on voice. Their study is idle mode centric [2].

2.3 Policy Refinement for DiffServ Qaulity of Services Management, Integrated Network Management.

A. Bandara, E. Lupu, A. Russo, N. Dulay, M. Sloman, P. Flegkas, M. Charalambides & G. Pavlou shows how to apply Policy refinement to the domain of DiffServ QoS management. In their study they have shown how policy can be refined and what tool support can be provided for the refinement process using examples from QoS management domain. They have used diffServ QOS modeling algorithm that uses Goal Elaboration & Abductive reasoning [3].

2.4 The Simulation of static Load Balancing Algorithms.

Hendra Rahmawan & Yudi Satria Gondokaryono has worked on simulation of static load balancing algorithms. Four static load balancing algorithms were simulated and their performances were compared. CPU, Memory and hard disk I/O were the load indices used. There were no performance penalties for Handovers. They have used round robin, randomized, central manager and threshold algorithm to carried out their work and found that central Manager algorithm is the best static load balancing algorithm that gives fastest execution time on the other hand both Central Manager and

Academic Science

Threshold algorithm are found to be the best static load balancing algorithm that able to balance loads well [4].

2.5 Traffic Load Balance Methods in the LTE-Advanced System with Carrier Aggregation.

Lei Zhang, Fei Liu, Lin Huang and Wenbo Wang in their paper have proposed two traffic load balance methods to improve the performance of the independent carrier scheduling (ICS) scheme in carrier aggregation based LTE advanced system with time variant user population. One was to utilize advanced user allocation rules and the other was a novel method which couples the component carriers (CCs) together in the scenario that the CCs are in the different working states. Simulation results showed that well designed user allocation rules can achieve better traffic load balance across the CCs than the simplest random allocation rule [5].

2.6 Potential of intra-LTE, intra-frequency load balancing.

Siegfried Klein, Ingo Karla & Edgar Kuehn compares different load balancing mechanisms and their combinations in respect to their performance. Their investigation was focused on three load balancing mechanism: handover parameter adaptation, antenna till adaptation and inter cell interference coordination. Simulation results showed that used techniques are complementary , Handover parameter variations and antenna tilt adaptation excel for overloaded cells In low and medium load environments, while inter cell interference coordination significantly improves the performance especially in high load environments [6].

2.7 Optimization of a Fuzzy Logic Controller for Handover-based Load Balancing.

P. Munoz, R. Barco, I. de la Bandera, M. Toril and S. Luna-Ramırez have worked on cost effective solution to increase network capacity. They were looking for fine tuning of handover parameters to achieve cell load balance in GSM-EDGE Radio Access Network (GERAN). They optimized Fuzzy Logic Controller (FLC) that significantly reduce the call blocking and provides good performance and usability. The optimized logic has been tested via MATLAB using Fuzzy Q Learning algorithm [7].

2.8 Enhanced Resource Sharing Strategies for LTE Picocells with Heterogenous Traffic Loads.

Veronique Capdevielle, Afef Feki and Elias Temer addresses the problem of spectrum sharing for LTE Pico cells(PCs) networks with heterogeneous traffic loads and enhanced resource sharing strategies. It was an innovative approach for spectrum sharing. Resources are selected and updated by each PC in an autonomous way. The need was to optimize the overall throughput and to responds to the real traffic requirements [8].

2.9 Analysis of Isuses with Load Balancing Algorithms in Hosted (Cloud) Environments.

Branko Radojevic, Mario Zagar covers the analysis of detected issues with load balancing algorithms in hosted (cloud) environments. They found that it is not enough to provide information from networking part of the computer system or from external load balancer to provide valuable information and influence the decision making of a load balancer. They have designed a new algorithm that incorporates information from virtualized computer environments and end user experience in order to be able to proactively influence load balancing decisions or reactively change decision in handing critical situations [9].

Table 1: Summary of various traffic load balancing and policy management solutions

SNo	Paper Name	Year	Author	Worked On	Tools Used	Algorithm	Conclusion	Future Work
1	Force-based Load Balancing in co-located UMTS/GSM Networks	2004	Andreas Pillekeit, Fariborz Derakhshan, Enrico Jugl, Andreas Mitschele-Thiel	• Focuses on intelligent algorithms that decide the load balancing between the different radio technologies • Algorithm used, is based on the approach previously employed to balance the load of distributed computing systems. • Study of algorithm has been done for optimum assignment of mobiles to a radio technology during call setup as well as during the call	Simulation Tool for the Evaluation of Algorithm in Mobile Networks (STEAM)	Force Based CRRM Algorithm	• Overall capacity and the provided QoS could be vastly improved in the case of overload situations. • The algorithm also proved very robust with respect to changes of the parameters • Connected Mode based Solution • But a decentralized solution • Nice simplification of problem • Candidate based solution • One way UMTS-GSM HOs as GSM call are unlikely to support UMTS • Algorithm to prevent Ping-Pongs	• Application of the CRRM algorithm to packet-switched traffic • Extensions of the algorithms to handle more complex multilayer systems including multiband UMTS networks
2	Traffic Steering and Service Continuity in GSM-WCDMA Seamless networks	2005	D. Truina , A. Furuskar	• Focused on how best GSM & WCDMA take advantage of each other • Handover between 2G & 3G networks requires efficient mechanisms for traffic management between them and support for service continuity at the time of system changeover	Load Balance Tool (by Ericsson)	Capacity Modeling Algorithm	• Need of Traffic Steering and Service continuity mechanism to introduce WCDMA along with GSM • Inter-System Changes to be kept to a minimum so that the performance could be maximize • Targeted voice service for service continuity by providing efficient traffic steering mechanism and Introduce load balancing solutions based on voice • Avoids inter-RAT HO due to long service disruption • Idle mode centric	• In Long Run, Penetration of WCDMA Increases, hence it may requires to address traffic-steering and service-continuity mechanisms for packet data services. • How to distribute load from subscribers in idle mode.
3	Policy Refinement for DiffServ Quality of Services Management	2005	A. Bandara, E. Lupu, A. Russo, N. Dulay, M. Sloman, P. Flegkas, M. Charalambides, G. Pavlou	• This paper shows how to apply Policy refinement to the domain of DiffServ QoS management. • This paper shows how policy can be refined and what tool support can be provided for the refinement process using examples from QoS management domain.	NA	Goal Elaboration & Abductive reasoning	By using goal elaboration and abductive reasoning strategies with events and constraints, it shows how policies can be refined	Further study is suppose to do on analysis capabilities to evaluate the consistency of the results
4	The Simulation of static Load Balancing Algorithms	2009	Hendra Rahmawan, Yudi Satria Gondokaryono	• Four static load balancing algorithms are simulated and their performance are compared. • CPU, Memory and hard disk I/O are the load indices used.	Discrete event simulator	Round Robin, Randomized, Central Manager, and Threshold	• Central Manager algorithm is the best static load balancing algorithm that gives fastest execution time • Central Manager and Threshold algorithm both are the two best static load balancing algorithm that able to balance loads well • A good simulation made example • No performance penalties for HO	• To simulate other load balancing algorithm • To evaluate performance on parameters other than execution time and work load distribution • To simulate for heterogeneous system.
5	Analysis of Issues with Load Balancing Algorithms in Hosted (Cloud) Environments	2010	Branko Radojević, Mario Žagar	• Analysis of detected issues with load balancing algorithms in Hosted environments. • The new algorithm incorporates information form virtualized computer environments and end user experience in order to be able to proactively influence load balancing decisions or reactively change decision in handling critical situations	NA	Round Robin Algorithm	Bad/poor Load balancing decisions can be avoided by having advanced load balancing models and algorithm that can dynamically adapt to situations on servers to which they actually forward traffic.	Further development of this model is the field were future research will be conducted
6	Traffic Load Balance Methods in the LTE-Advanced System with Carrier Aggregation	2010	Lei Zhang, Fei Liu, Lin Huang and Wenbo Wang	• Two traffic load balance methods are proposed to improve the performance of the independent carrier scheduling (ICS) scheme in carrier aggregation based LTE-advanced system with time-variant user population. • One is to utilize advanced user allocation rules. • The other is a novel method which couples the component carriers (CCs) together in the scenario that the CCs are in the different working states.	NA	Joint carrier scheduling scheme (JCS) Independent Carrier Scheduling Scheme (ICS) Advanced User Allocation Rules	• Simulation results showed that well designed user allocation rules can achieve better traffic load balance across the CCs than the simplest random allocation rule. • the CC coupling method can make the ICS scheme achieve optimal performance as the joint carrier scheduling (JCS) scheme, irrespective of the traffic intensity and the used user allocation rule. • JSQ is the most efficient user allocation rule to balance the traffic load across the CCs • ICS can perform close the JCS by using JSQ, when the traffic intensity is very heavy.	NA

SNo	Paper Name	Year	Author	Worked On	Tools Used	Algorithm	Conclusion	Future Work
7	Optimization of a Fuzzy Logic Controller for Handover-based Load Balancing	2011	P. Mu˜noz, R. Barco, I. de la Bandera, M. Toril and S. Luna-Ram´ırez	• Fine tuning of Handover parameters to achieve cell load balance in GSM-EDGE Radio Access Network (GERAN). • Fuzzy Logic Controller (FLC) provides good performance and usability	MATLAB	FUZZY Q Learning algorithm	• Optimized FLC provinces a significant reduction in call blocking. • Cost effective solution to increase network capacity	• How to control call drops which get incremented due to this solution • How to control network signaling load due to a higher number of Handovers
8	Enhanced Resource Sharing Strategies for LTE Pico cells with Heterogeneous Traffic Loads	2011	Veronique Capdevielle, Afef Feki and Elias Temer	• This paper addresses the problem of spectrum sharing for LTE pico cells (PCs) networks with heterogeneous traffic loads • Design of Distributed mechanisms to steer PCs to select most suitable resources • To maximize overall Throughput • To responds to the real traffic needs	3D ray tracing tool	Dynamic Cooperative Algorithms (DCA) & Dynamic NonCooperative Algorithms (DNCA)	• Innovative approach for spectrum sharing. • Resources are selected and updated by each PC in an autonomous way. • Create and objective function using queuing theory Cost function • Optimized solution that optimizes the overall throughput.	How to reuse self-adaptive spectrum through an increasing/decreasing spectrum allocation mechanism that dynamically adjusts the selected resource to the real needs.
9	Load Balancing between TD-SCDMA and GSM Systems with Asymmetric Traffics	2011	Liang Lei1, Aiping Huang1, Cunqing Hua1, Zhouyun Wu1, Jun Qian2, Liang Shen3, Xinwei Chen3, Yusheng Zhang3	• This paper investigated load balancing between heterogeneous TD-SCDMA and GSM systems with asymmetric traffics • Analysis has been done on trigger condition of handoff operation, the traffic volume to be migrated and the criteria of selecting users to be migrated for each case.	NA	handoff balancing algorithm	• This load balancing can make the load gap of the concerned link smaller , and the performance of the higher-load system has improved efficiently. • When and how to move UE via inter-RAT • User Priority & Selection	NA
10	Joint Optimization on Load Balancing and Network Load in 3GPP LTE Multi-cell Networks	2011	Zhihang Li, Hao Wang, Zhiwen Pan, Nan Liu and Xiaohu You	• This paper investigated load balancing and network load minimization in 3GPP LTE mutli-cell networks. • Firstly, the problem was formulated to be a multi-optimization problem , then complexity and overhead of the optimal solution of the problem had been analyzed. • After that, a practical and low-overhead algorithm, NLMLB was proposed which includes a handover decision process and a call admission control process.	NA	Network Load Minimization with Load Balancing algorithm (NLMLB)	Simulation results showed that NLMLB algorithm can effectively decrease the new call blocking rate, reduce network resource occupation and increase the network bandwidth efficiency.	NA
11	Potential of intra-LTE, intra-frequency load balancing	2011	Siegfried Klein, Ingo Karla, Edgar Kuehn	• This paper compares different load balancing mechanisms and their combinations in respect to their performance.. • The investigation focuses on three load balancing mechanisms: handover parameter adaptation , antenna tilt adaptation and inter cell interference coordination	Downlink Simulator	NA	Simulation results showed that used techniques are complementary , Handover parameter variations and antenna tilt adaptation excel for overloaded cells In low and medium load environments, while inter cell interference coordination significantly improves the performance especially in high load environments	NA

2.10 Load Balancing between TD-SCDMA and GSM Systems with Asymmetric Traffics.
Liang Lei, Aiping Huang, Cunqing Hua1, Zhouyun Wu, Jun Qian, Liang Shen, Xinwei Chen & Yusheng Zhang together investigated load balancing between heterogeneous TD-SCDMA and GSM systems with asymmetric traffics. They have done analysis on trigger condition of handoff operation, the traffic volume to be migrated and the criteria of selecting users to be migrated for each case. Handoff balancing algorithm was being used that prioritize when and how to move UE via inter-RAT [10].

2.11 Joint Optimization on Load Balancing and Network Load in 3GPP LTE Multi-cell Networks.
Zhihang Li, Hao Wang, Zhiwen Pan, Nan Liu and Xiaohu You investigated load balancing and network load minimization of 3GPP LTE multicell networks. Firstly, the problem was formulated to be a multi-optimization problem, and then complexity and overhead of the optimal solution of the problem had been analyzed. After that, a practical and low-overhead algorithm, NLMLB was proposed which includes a handover decision process and a call admission control process. NLMLB is Network Load Minimization with Load Balancing Algorithm. Simulation results showed that NLMLB algorithm can effectively decrease the new call blocking rate, reduce network resource occupation and increase the network bandwidth efficiency [11].

CONCLUSION

This paper has provided a more current evaluation and update of real time traffic monitoring and load balancing techniques available. Extensive literature has been reviewed based on monitoring parameters like real time traffic, congestion avoidance, load balancing and QoS management. This paper has also reported the summaries of all previous related work in a tabulated format and for each work, key omissions and scope of future work have been identified to address key policy aspects. This paper identifying the related issues and their solution regarding how to improve end user QoS during network congestion by adapting network bandwidth and manages user profile dynamically.

REFERENCES

[1] Andreas Pillekeit, Fariborz Derakhshan, Enrico Jugl, Andreas Mitschele-Thiel,Force-based Load Balancing in co-located UMTS/GSM Networks, Vehicular Technology Conference, 2004. VTC2004-Fall. 2004 IEEE 60th, 26-29 Sept. 2004, 4402 – 4406, Vol. 6, IEEE.
[2] D. Truina , A. Furuskar,Traffic Steering and Service Continuity in GSM-WCDMA Seamless networks, IEEE, Vol.1, 77-82, 2005.
[3] A. Bandara, E. Lupu, A. Russo, N. Dulay, M. Sloman, P. Flegkas, M. Charalambides, G. Pavlou,Policy Refinement for DiffServ Qaulity of Services Management, Integrated Network Management, 2005. IM 2005. 2005 9th IFIP/IEEE International Symposium on, 15-19 May 2005 , 469 – 482, IEEE.
[4] Hendra Rahmawan, Yudi Satria Gondokaryono,The Simulation of static Load Balancing Algorithms, Electrical Engineering and Informatics, 2009. ICEEI '09. International Conference, Selangor , 5-7 Aug. 2009, 640 – 645, IEEE.

[5] Lei Zhang, Fei Liu, Lin Huang and Wenbo Wang,Traffic Load Balance Methods in the LTE-Advanced System with Carrier Aggregation, Communications, Circuits and Systems (ICCCAS), 2010 International Conference on, Chengdu, 28-30 July 2010, 63 – 67, IEEE.
[6] Siegfried Klein, Ingo Karla, Edgar Kuehn,Potential of intra-LTE, intra-frequency load balancing, Vehicular Technology Conference , 73rd, Budapest, 15-18 May 2011, 1 – 5, IEEE.
[7] P. Munoz, R. Barco, I. de la Bandera, M. Toril and S. Luna-Ramirez,Optimization of a Fuzzy Logic Controller for Handover-based Load Balancing, IEEE, 1-5, 2011
[8] Veronique Capdevielle, Afef Feki and Elias Temer,Enhanced Resource Sharing Strategies for LTE Picocells with Heterogenous Traffic Loads, Vehicular Technology Conference (VTC Spring), Budapest , 15-18 May 2011 , 1 – 5, IEEE.
[9] Branko Radojevic, Mario Žagar,Analysis of Isuses with Load Balancing Algorithms in Hosted (Cloud) Environments, MIPRO, 2011 Proceedings of the 34th International Convention , Opatija , 23-27 May 2011, 416 – 420, IEEE.
[10] Liang Lei1, Aiping Huang1, Cunqing Hua1, Zhouyun Wu1, Jun Qian2, Liang Shen3, Xinwei Chen3, Yusheng Zhang3,Load Balancing between TD-SCDMA and GSM Systems with Asymmetric Traffics, Communications and Networking in China (CHINACOM), 2011 6th International ICST Conference on, Harbin , 17-19 Aug. 2011, 289 – 294,IEEE.
[11] Zhihang Li, Hao Wang, Zhiwen Pan, Nan Liu and Xiaohu You,Joint Optimization on Load Balancing and Network Load in 3GPP LTE Multi-cell Networks, Wireless Communications and Signal Processing (WCSP), 2011 International Conference on, Nanjing, 9-11 Nov. 2011, 1 – 5.