International Journal of Advance in Computer Science & its application – IJCSIA 2018
Copyright © Institute of Research Engineers and Doctors , SEEK Digital Library
Volume 7 : Issue 2 [ISSN : 2250-3765] - Publication Date: 25 June , 2018

Trend Analyses of Critical Values Obtained for Sender Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies.

M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY

***Abstract* – Consequential research is currently being invested on as concerns location-tracking, ubicomp functionalities and MANET transmission strategies [1-56]. Attempts for their merging are still at early stages and are not yielding commendable results. One crucial factor for this successful merging remains correct protocol design approaches, which is currently regarded as heuristic and inadequately suited for implementation [94]. Advancements in middleware services and ubicomp network architecture are also desirable [95, 96].**

A well-structured objective that manifests along such development path in ubicomp is reaching out for "realism" in design and evaluation of wireless routing protocols [97]. Such studies will entail serious technical constituents useful for further studies of predictability in ubicomp. Their importance is high since "realism" will propagate into each ubicomp feature. One such feature was studied previously [25] to assess the trend of Sender Fairness Proportion (S_FP) observable for CBRs under different sets of node densities in ubicomp environments. This study was augmented with the study of S_FP parameter of equations [41].

To enfold "realism" in knowledge of these trends, in this paper, the successive study required is put forward as: "What are the observable critical values in S_FP trends over varying node densities and trends of such critical values?" Following such developments, the design of more realistic ubicomp schemes will succeed. These are entrusted to be more eligible for sustained testing of experimental middleware and communication protocols. This study dwells as a follow-up of prior ones [1-56].

Key terms: Ubicomp- Ubiquitous Computing, MAUC-Mobile and Ubiquitous Computing, S_FP- Sender Fairness Proportion, CBR- Constant Bit Rate, MANET- Mobile Adhoc Network, CV- Critical Value.

M. Kaleem GALAMALI,
University of Technology Mauritius (student)
Mauritius
mkaleemg@gmail.com

Assoc. Prof Nawaz Mohamudally
University of Technology Mauritius,
Mauritius
alimohamudally@umail.utm.ac.mu

1. Introduction

It is projected that many of the future ubicomp environments may be significantly under equipped with networking support and hence the welcome solution is expected to be MANETs. Here, the task of transmission is repartitioned among cooperating nodes leading to energy consumption being repartitioned. In such resulting situations, the notions of Fairness must be fully well circumscribed. One such notion is from the angle of metrics, one of which is S_FP, studied in a prior paper [25] for node densities varying between 7 until 56. The trend observed was split into two with respect to a peak value.

- Previous to the maximum point, the linear tendency is visible of form:
  `F(x) = d * x + f`
- As from the peak value onwards, the exponentially decreasing trend is visible of form:
  `G(x) = a * exp (b * (x-c))`

A follow-up study [41] was effectuated to model mathematically the five parameters observed above. Results obtained will definitely be useful towards better understanding the evolution and predictability of ubicomp environments. These advancements are slowly being delivered and will facilitate designers for preparing better realistic simulation scenarios based on which testing exercises can be undertaken over experimental components for middleware and communication protocols.

The probing now needed for metric S_FP is the identification of observable critical values obtained during experiments execution and formulation of corresponding theoretical trend of such CVs over varying node densities. Six such CVs were observed.

The key contribution of this paper is the mathematical formulation of the trends of variations for each of the six CVs observed for metric S_FP expounded previously [25, 41] over node numbers ranging from 7 until 56. Such variety of information should compulsorily be presented in an appropriate format to conveniently aid designers to understand the evolution and predictability of ubicomp behaviour and be sufficiently equipped to carry credulous simulation scenarios over which new communication features could be tested. The rest of this paper is organised as follows: section 2- S_FP Critical Values, section 3- Critical Values Trend Analyses- Metric S_FP, section 4- Conclusion and References.

International Journal of Advance in Computer Science & its application – IJCSIA 2018
Copyright © Institute of Research Engineers and Doctors , SEEK Digital Library
Volume 7 : Issue 2 [ISSN : 2250-3765] - Publication Date: 25 June , 2018

2. S_FP Critical Values.

2.0 Critical Values Identified.

Six CVs were identified as follows: Column headings are: C1→S_FP CV, C2→Meaning of S_FP CV, C3→Corresponding figure number for S_FP CV.

C1	C2	C3
1	% CBR at smallest value of S_FP	1
2	Highest value of S_FP	2
3	% CBR at highest value of S_FP	3
4	% CBR with S_FP value < modal S_FP value	4
5	% CBR with S_FP value > modal S_FP value	5
6	S_FP value up to which 97.5 % CBR lie	6

Table 1: S_FP Critical Values

2.1 Experimental Critical Values Obtained.

The values obtained during experiments have been summarised below. Values have been rounded to a maximum of 9 decimal places. Column heading NN → Node Number.

NN	CV1	CV2	CV3
7	0.158730159	7.0	1.984126984
8	13.482967208	8.0	1.957975167
9	13.555555556	9.0	1.888888889
10	10.777777778	10.0	0.714285714
11	10.619047619	11.0	0.714285714
12	10.763116057	12.0	0.635930048
13	10.666666667	13.0	0.555555556
14	10.666666667	14.0	0.476190476
15	10.666666667	15.0	0.476190476
16	10.746031746	16.0	0.476190476
17	10.666666667	17.0	0.238095238
18	10.888888889	18.0	0.238095238
19	10.746031746	19.0	0.222222222
20	10.666666667	20.0	0.222222222
21	10.095238095	21.0	0.301587302
22	10.174603175	22.0	0.301587302
23	10.174603175	23.0	0.301587302
24	10.174603175	24.0	0.301587302
25	10.269841270	25.0	0.238095238
26	10.619047619	26.0	0.238095238
27	10.539682540	27.0	0.238095238
28	10.460317460	28.0	0.238095238
29	10.539682540	29.0	0.238095238
30	10.682539683	30.0	0.238095238
31	10.730158730	31.0	0.158730159
32	10.714285714	32.0	0.158730159
33	10.682539683	33.0	0.158730159
34	10.650793651	34.0	0.158730159
35	10.571428571	35.0	0.158730159
36	10.571428571	36.0	0.158730159
37	9.953960946	37.0	0.238133037
38	9.952380952	38.0	0.238095238
39	10.031746032	39.0	0.238095238
40	10.031746032	40.0	0.238095238
41	10.031746032	41.0	0.238095238
42	10.031746032	42.0	0.238095238
43	10.333333333	43.0	0.238095238
44	10.419313850	44.0	0.238246506
45	10.333333333	45.0	0.238095238
46	10.333333333	46.0	0.238095238
47	10.333333333	47.0	0.238095238
48	10.333333333	48.0	0.238095238
49	10.412698413	49.0	0.238095238
50	10.174603175	50.0	0.238095238
51	10.158730159	51.0	0.238095238
52	10.158730159	52.0	0.238095238
53	10.158730159	53.0	0.238095238
54	10.079365079	54.0	0.238095238
55	10.158730159	55.0	0.238095238
56	10.126984127	56.0	0.238095238

Table 2(a): Experimental Critical Values Obtained(1)

NN	CV4	CV5	CV6
7	11.301587302	82.619047619	6.3
8	24.864692773	69.659344158	7.2
9	39.412698413	55.603174603	8.1
10	38.746031746	55.587301587	5.3
11	29.317460317	64.698412698	5.5
12	30.461049285	63.863275040	5.0
13	23.793650794	69.603174603	5.0
14	25.126984127	68.380952381	5.0
15	25.015873016	68.444444444	5.3
16	31.063492063	61.857142857	5.0
17	32.111111111	61.142857143	5.4
18	32.603174603	60.396825397	5.3
19	32.761904762	60.190476190	5.3
20	32.857142857	59.857142857	5.4
21	31.888888889	60.301587302	5.3
22	32.857142857	59.571428571	5.4
23	33.015873016	59.031746032	5.3
24	33.285714286	58.428571429	5.6
25	34.111111111	58.111111111	5.6
26	25.936507937	66.507936508	5.0
27	33.698412698	58.682539683	4.6
28	34.428571429	57.793650794	4.9
29	27.015873016	65.301587302	4.7
30	27.047619048	64.555555556	4.6
31	25.158730159	65.269841270	4.8
32	25.825396825	65.682539683	4.5
33	26.047619048	64.904761905	4.6
34	26.126984127	65.047619048	4.6
35	25.857142857	65.793650794	4.2
36	26.269841270	65.730158730	4.7
37	25.591363709	64.883314812	4.9
38	25.761904762	64.904761905	4.6
39	25.603174603	64.968253968	4.8
40	25.095238095	65.222222222	4.7
41	24.666666667	65.714285714	4.7
42	25.079365079	65.634920635	4.9
43	25.095238095	65.904761905	4.5
44	24.904701398	65.803684879	4.4
45	25.095238095	65.095238095	4.0
46	25.285714286	65.682539683	4.0
47	24.587301587	66.047619048	4.1
48	24.888888889	65.095238095	4.2

49	24.746031746	65.031746032	4.0
50	26.444444444	64.650793651	4.2
51	35.285714286	55.920634921	4.2
52	35.349206349	55.206349206	4.2
53	35.285714286	56.047619048	4.3
54	26.619047619	64.507936508	4.3
55	26.841269841	64.142857143	4.3
56	35.555555556	55.952380952	4.4

Table 2(b): Experimental Critical Values Obtained(2)

3. Critical Values Trend Analyses- Metric S_FP.

3.0 General Procedure Adopted.

The initial step is to plot the tabulated data for each S_FP CV on gnuplot. The following step is to perform graphical analyses and describing the general observations reachable. In the third step, the applicability of certain selected equations of fit is explored. Choice of best fit is based on values of least reduced chi-square and best extendability produced at node numbers 80, 100 and 120 for five CVs and for one CV, it takes the exact value of x (i.e. the node number). The last step consist of recording the values of parameters for each S_FP CV equation.

3.1 Trend Analysis – S_FP CV1.

Here, the plots depict a mild oscillation along a mildly decreasing straight line. One plot is largely outlying and 2 plots are quite outlying.

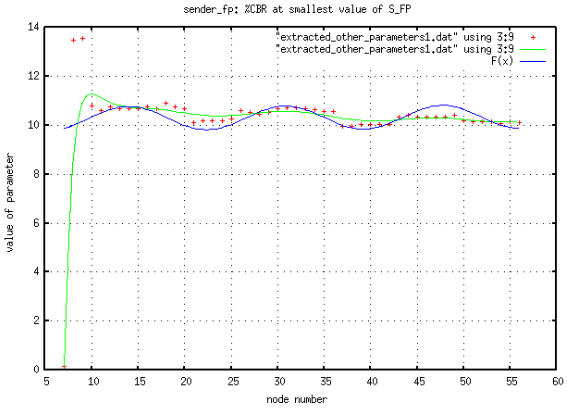

Figure 1: S_FP Critical Value 1

$F(x) = a * \sin((b*x)+c) + d*x + f$

Ch_sq = 2.591 48 F(80) = 10.793 286 344

F(100) = 10.800 324 853 F(120) = 10.334 834 442

The parameters of fit are:

a = -0.481 109 , b = 0.372 298 , c = -0.481 889 , d = 0.001 360 353 397 , f = 10.272 584 907 745 6

3.2 Trend Analysis – S_FP CV2.

Here, the y-axis value varies exactly as x-axis value, i.e. node number.

$F(x) = x$

Sum of squares of residuals = 0

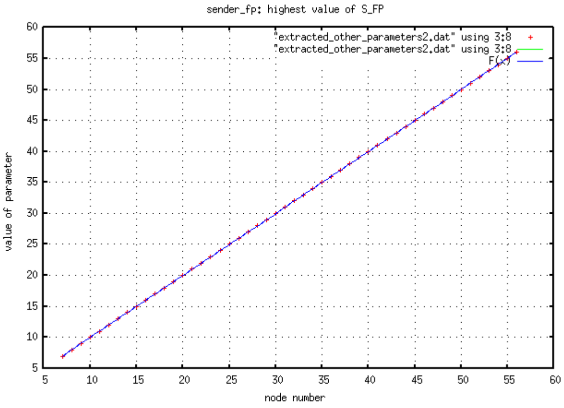

Figure 2: S_FP Critical Value 2

3.3 Trend Analysis – S_FP CV3.

In the beginning third of the plot, the curve depicts a decreasing trend at a decreasing rate. Then the curve tends to stabilise at a value between 0 and 0.5

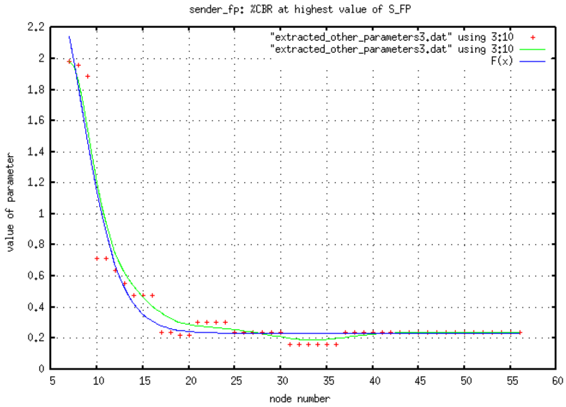

Figure 3: S_FP Critical Value 3

The potentially applicable equations are:

1. $F(x) = a * \exp((b*x) + c) + d$
   Ch_sq = 0.013 690 8 F(80) = 0.220 743 550
   F(100)= 0.220 743 548 F(120)= 0.220 743 548
2. $F(x) = a * x * \exp((b*x)+c) + d$
   Ch_sq = 0.012 982 F(80) = 0.224 615 737
   F(100)= 0.224 615 737 F(120)= 0.224 615 737
3. $F(x) = a * x^2 * \exp((b*x)+c) + d$
   Ch_sq = 0.012 442 7 F(80) = 0.227 882 183
   F(100)= 0.227 882 183 F(120)= 0.227 882 183
4. $F(x) = a * x^3 * \exp((b*x)+c) + d$
   Ch_sq = 0.012 030 2 F(80) = 0.230 707 572
   F(100)= 0.230 707 572 F(120)= 0.230 707 572
5. $F(x) = a * x^4 * \exp((b*x)+c) + d$
   Ch_sq = 0.011 715 F(80) = 0.233 222 547
   F(100)= 0.233 222 547 F(120)= 0.233 222 547

Choice of best fit for S_FP Critical value 3

The equation in part 5 above has been selected because of least ch_sq and good extendability. The parameters for best fit are: a= 0.047 458 6 , b= -0.725 878 , c= 0.993 435 , d = 0.233 223

3.4 Trend Analysis – S_FP CV4.

The plot here appears to be taking oscillating tendency.

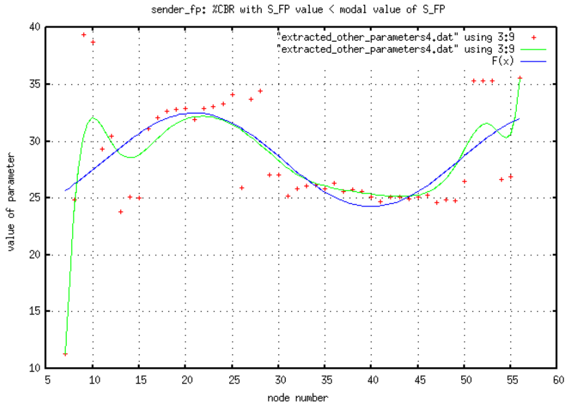

Figure 4: S_FP Critical Value 4

F(x) = a * sin ((b*x) + c) + d

Ch_sq = 18.447 5 F(80) = 24.450 323 674

F(100)= 32.044 691 978 F(120)= 25.026 294 954

The parameters of fit are: a = 4.123 57 , b = 0.164 81 , c = -1.873 12 , d = 28.369 6

3.5 Trend Analysis – S_FP CV5.

Again, plot appears to be taking oscillating tendency.

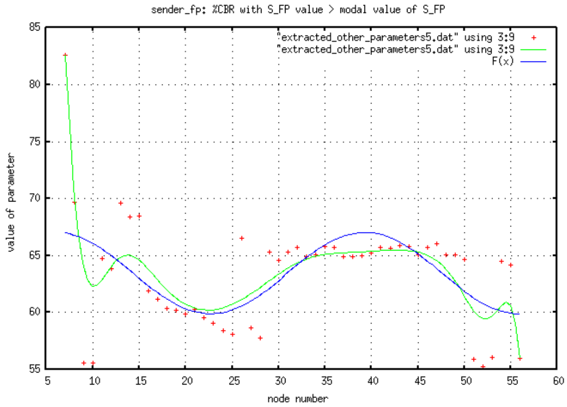

Figure 5: S_FP Critical Value 5

F(x) = a * sin ((b * x) + c) + d

Ch_sq = 17.798 4 F(80) = 64.024 288 280

F(100) = 65.102 308 717 F(120) = 60.245 185 203

The parameters of fit are: a = 3.575 12 , b = -0.188 958 , c = 2.710 07 , d = 63.456 8

3.6 Trend Analysis – S_FP CV6.

Here also, the plot here appears to be taking oscillating tendency along a decreasing axis.

The potentially applicable equations are:

1. F(x)= a*sin ((b*x)+c) + (d*x) + f

   Ch_sq = 0.162 726 F(80) = 2.576 600 529

   F(100)= 2.286 203 567 F(120)= 1.712 114 622

2. F(x)=a*sin ((b*x)+c)+(d/log (x))+f

   Ch_sq = 0.138 654 F(80) = 3.935 650 458

   F(100)= 3.643 763 449 F(120)= 3.685 477 317

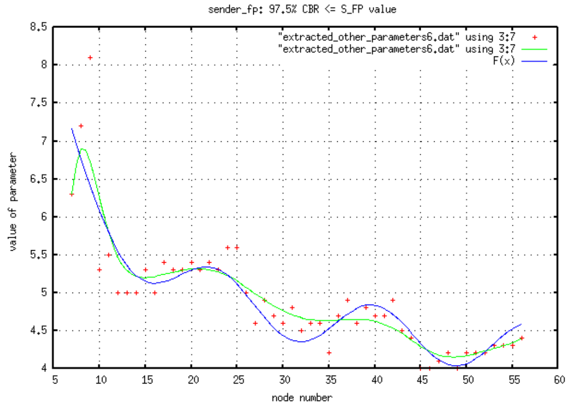

Figure 6: S_FP Critical Value 6

4. Conclusion.

The aim of this study was to determine the relevant CVs observable for metric S_FP and scrutinise their corresponding trends over varying node densities in a MANET topography of 300 x 300 m^2. The models illustrated in this paper, are composed of mathematical equations of varying complexity. The output detailed here will add to the set of existing tools for more expert studies of MANETs for ubicomp environments viewed from software engineering. These output can meticulously be implemented into computational algorithms to generate better simulation scenarios which may serve for enabling better testing procedures over communication and middleware components.

This experiment was performed in NS-2 over Linux. Plottings and “Fit” attempts were done with gnuplot software. Selection of best fit was mostly made using least reduced chi-square values and best extendability produced at higher node numbers. Assumptions put forward in prior papers [25, 41].

This study aligns as a continuation to previous studies [1-56]. Improvements to these results remain possible in the future. A possible future work is the formulation of predictability for metric S_FP and its trend.

References

[1] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Towards Dependable Pervasive Systems-A Position and Vision Paper, CEET 2014

[2] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Energy Savings achievable with Location-aware Node-to-Node Transmission in UbiComp , CEET 2014

[3] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Energy Savings achievable with Location-aware Node-to-Node Transmission in UbiComp Using Location Refresh Intervals, CEET 2014

[4] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Energy Savings achievable with Location-aware Transmission in UbiComp Using

Relays, CEET 2014

[5] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Mathematical modeling of need of exact number of relays to ensure seamless mobility in mobile computing, CEET 2014

[6] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Modelling of need for multiple relays for ensuring seamless mobility, CEET 2014

[7] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Investigation of prominence of placements of relays in a ubicomp topography,

[8] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of energy savings achievable with location-aware transmission in ubicomp using optimised number of relays.

[9] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Investigation of Prominence of Placements of Optimised Number of Relays in a Ubicomp Topography using Location-Aware Transmission, CEET 2015.

[10] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Extending Node Battery Availability in Ubicomp with Location-Aware Transmission, CEET 2015.

[11] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Extending Node Battery Availability in Ubicomp with Location-Aware Transmission using Location Refresh Intervals, CEET 2015.

[12] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Extending Node Battery Availability in Ubicomp with Location-Aware Transmission using Uniformly Placed Relays, CEET 2015.

[13] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Extending Node Battery Availability in Ubicomp with Location-Aware Transmission Using Optimally Placed Relays, CEET 2015.

[14] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Sender Node Energy Savings Achievable with Location-Aware MANET Transmission in Ubicomp. ACCN 2016

[15] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Overall Node Energy Savings Achievable with Location-Aware MANET Transmission in Ubicomp. ACCN 2016

[16] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Sender Node Extra Energy Savings Achievable in MANET Against Direct Node-to-Node Transmission Using Location-Aware Transmission in Ubicomp. ACCN 2016

[17] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Overall Node Extra Energy Savings Achievable in MANET against Direct Node-to-Node Transmission Using Location-Aware Transmission in Ubicomp. ACCN 2016

[18] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Energy Consumption Ratio Achievable in MANET Using Location-Aware Transmission in Ubicomp. ACCN 2016

[19] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Minimum Energy Consumption Ratio Achievable in MANET Using Location-Aware Transmission in Ubicomp. ACCN 2016

[20] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Maximum Energy Consumption Ratio Achievable in MANET Using Location-Aware Transmission in Ubicomp. ACCN 2016

[21] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Overall Energy Consumption Fairness Ratio Achievable in MANET Using Location-Aware Transmission in Ubicomp. ACCN 2016

[22] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Overall Energy Consumption Fairness Proportion Achievable in MANET Using Location-Aware Transmission for Ubicomp, CEET 2016

[23] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Minimum Fairness Proportion Achievable in MANET Using Location-Aware Transmission for Ubicomp, CEET 2016

[24] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Maximum Fairness Proportion Achievable in MANET Using Location-Aware Transmission for Ubicomp, CEET 2016

[25] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Sender Fairness Proportion Achievable in MANET Using Location-Aware Transmission for Ubicomp, CEET 2016

[26] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Distance Travelled by packets in MANETs using Location-Aware Transmission for Ubicomp, CEET 2016

[27] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Maximum CBR Distance Travelled by packets in MANETs using Location-Aware Transmission for Ubicomp, CEET 2016

[28] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Minimum CBR Distance Travelled by packets in MANETs using Location-Aware Transmission for Ubicomp, CEET 2016

[29] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Model of Range CBR Distance Experienced by Transmissions in MANETs using Location-Aware Transmission for Ubicomp, CEET 2016

[30] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Sender Node Energy Savings Achievable in ubicomp MANETs using Location-Aware Transmission, ACCN 2017.

[31] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Overall Node Energy Savings Achievable in ubicomp MANETs using Location-Aware Transmission, ACCN 2017.

[32] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Sender Node Extra Energy Savings Achievable in MANET against Direct Node-to-Node Location-Aware Transmission, ACCN 2017.

[33] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Overall Nodes Extra Energy Savings Achievable in MANET against Direct Node-to-Node Location-Aware Transmission, ACCN 2017.

[34] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Energy Consumption Ratio Achievable in Ubicomp MANET Using Location-Aware Transmission, ACCN 2017.

[35] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Minimum Energy Consumption Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission, ACCN 2017.

[36] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Maximum Energy Consumption Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission, ACCN 2017.

[37] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Overall Fairness Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission, ACCN 2017.

[38] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Energy Consumption Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[39] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Minimum Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[40] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Maximum Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[41] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Sender Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission,

CEET 2017

[42] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Packets Per Distance Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[43] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Maximum CBR Distance Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[44] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Minimum CBR Distance Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[45] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Parameters of Equations for Range CBR Distance Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[46] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Sender Node Energy Savings Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[47] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Overall Node Energy Savings Achievable in Ubicomp MANETs Using Location-Aware Transmission, CEET 2017

[48] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Sender Node Extra Energy Savings Achievable in Ubicomp MANET Against Direct Node-to-Node Location-Aware Transmission, CEET 2017

[49] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Overall Nodes Extra Energy Savings Achievable in Ubicomp MANET Against Direct Node-to-Node Location-Aware Transmission, CEET 2017

[50] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Energy Consumption Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, CEET 2017

[51] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Minimum Energy Consumption Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, CEET 2017

[52] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Maximum Energy Consumption Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, CEET 2017

[53] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Overall Fairness Ratio Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, CEET 2017

[54] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Energy Consumption Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, ACCN 2017.

[55] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Minimum Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, ACCN 2017.

[56] M. Kaleem GALAMALI, Assoc. Prof Nawaz MOHAMUDALLY, Trend Analyses of Critical Values Obtained for Maximum Fairness Proportion Achievable in Ubicomp MANETs Using Location-Aware Transmission Strategies, ACCN 2017.

[57] Markus Bylund and Zary Segall, Towards seamless mobility with personal servers, 2004.

[58] Masugi Inoue, Mikio Hasegawa, Nobuo Ryoki and Hiroyuki Morikawa, Context-Based Seamless Network and Application Control, 2004

[59] Xiang Song, Umakishore Ramachandran, MobiGo: A Middleware for Seamless Mobility, College of Computing Georgia Institute of Technology, Atlanta, GA, USA, August 2007

[60] Budzisz, Ferrús, R., Brunstrom A., Grinnemo, K, Fracchia, R., Galante, G., and Casadevall, F. Towards transport-layer mobility: Evolution of SCTP multihoming, March 2008

[61] Paul Dourish & Genevieve Bell, Divining a digital future, 2011.

[62] Xiang Song, Seamless Mobility In Ubiquitous Computing Environments, PhD Thesis, Georgia Institute of Technology, August 2008

[63] Kevin O Mahony, Jian Liang, Kieran Delaney, User-Centric Personalization and Autonomous Reconfiguration Across Ubiquitous Computing Environments, NIMBUS Centre Cork Institute of Technology, Cork, Ireland, UBICOMM 2012

[64] Pablo Vidales, Seamless mobility in 4G systems, *Technical Report, University of Cambridge*, Computer Laboratory, Number 656, November 2005

[65] João Pedro Sousa and David Garlan, Aura: An Architectural Framework for User Mobility in Ubiquitous Computing Environments, School of Computer Science, Carnegie Mellon University, USA, *August 2002*

[66] Dennis Lupiana, Ciaran O'Driscoll, Fredrick Mtenzi, Defining Smart Space in the Context of Ubiquitous Computing, Dublin Institute of Technology, Ireland, Special Issue on ICIT 2009 Conference - Web and Agent Systems, 2009

[67] N.S.V.Shet1, Prof.K.Chandrasekaran2 and Prof. K.C.Shet3, *WAP Based Seamless Roaming In Urban Environment with Wise Handoff Technique*, International Journal of UbiComp (IJU), Vol.1, No.4, October 2010

[68] Yipeng Yu Dan He Weidong Hua Shijian Li Yu Qi Yueming Wang Gang Pan, FlyingBuddy2: A Brain-controlled Assistant for the Handicapped, Zhejiang University, *UbiComp'12,* September 5-8, 2012.

[69] Jing Su, James Scott, Pan Hui, Jon Crowcroft, Eyal de Lara Christophe Diot, Ashvin Goel, Meng How Lim, and Eben Upton, Haggle: Seamless Networking for Mobile Applications, 2007

[70] Rui Han, Moustafa M. Ghanem, Li Guo, Yike Guo∗, Michelle Osmond, Enabling cost-aware and adaptive elasticity of multi-tier cloud applications, Future Generation Computer Systems, 2012

[71] Byrav Ramamurthy, K. K. Ramakrishnan , Rakesh K. Sinha, Cost and Reliability Considerations in Designing the Next-Generation IP over WDM Backbone Networks, 2012.

[72] Bhavish Aggarwal, Aditya Akella, Ashok Anand, Athula Balachandran, Pushkar Chitnis, Chitra Muthukrishnan, Ram Ramjee and George Varghese, EndRE: An End-System Redundancy Elimination Service for Enterprises, NSDI 2010, San Jose, CA

[73] Ashok Anand, Vyas Sekar and Aditya Akella, SmartRE: An Architecture for Coordinated Network-wide Redundancy Elimination, SIGCOMM 2009, Barcelona, Spain

[74] John Breeden II, "Smart-phone battery life could double – without better batteries", Nov 14, 2012

[75] Andy Boxall, "When will your phone battery last as long as your kindle", December 5, 2012.

[76] Imielinski, T. and Navas, J.C. (1999). GPS-based geographic addressing, routing, and resource discovery. *Comms. ACM*, Vol. 42, No. 4, pp. 86-92.

[77] Hightower, J. and Borriello, G. (2001). Location Systems for Ubiquitous Computing. *IEEE Computer*, Vol. 34, No. 8, August, pp. 57-66.

[78] Harter, A., Hopper, A., Steggles, P., Ward, A. and Webster, P. (2002). The Anatomy of a Context-Aware Application. Wireless Networks, Vol. 8, No. 2-3, Mar-May, pp. 187-197.

[79] Hightower, J., Brumitt, B. and Borriello, G. (2002). The Location Stack: A Layered Model for Location in Ubiquitous Computing. *Proceedings of the 4th IEEE Workshop on Mobile Computing Systems & Applications (WMCSA 2002)*, Callicoon, NY, USA, June, pp. 22-28.

[80] Graumann, D., Lara, W., Hightower, J. and Borriello, G. (2003). Real-world implementation of the Location Stack: The Universal Location Framework. *Proceedings of the 5th IEEE Workshop on Mobile Computing Systems & Applications (WMCSA 2003)*, Monterey, CA, USA, October, pp. 122-128.

[81] Ko, Y., & Vaidya, N. H. (2000). Location-aided routing (LAR) in mobile ad hoc networks. *Wireless Networks*, *6*(4), 307-321.

[82] Liao, W.-H., Tseng, Y.-C., & Sheu, J.-P. (2001). GRID: a fully location-aware routing protocol for mobile ad hoc networks. *Telecommunication Systems*, *18*(1), 37-60.

[83] Kuhn, F., Wattenhofer, R., Zhang, Y., & Zollinger, A. (2003). Geometric ad-hoc routing: of theory and practice. In *Proceedings of the ACM (PODC'03)* (pp. 63-72).

[84] Jiang, X., & Camp, T. (2002). Review of geocasting protocols for a mobile ad hoc network. In Proceedings of the *Grace Hopper Celebration (GHC)*.

[85] Ko, Y. & Vaidya, N. H. (1999). Geocasting in mobile ad hoc networks: location-based multicast algorithms. In *Proceedings of the IEEE (WMCSA'99)* (pp. 101).

[86] Mauve, M., Fuler, H., Widmer, J., & Lang, T. (2003). *Position-based multicast routing for mobile ad-hoc networks* (Technical Report TR-03-004). Department of Computer Science, University of Mannheim.

[87] Xu, Y., Heidemann, J., & Estrin, D. (2001). Geography-informed energy conservation for adhoc routing. In *Proceedings of the ACM/IEEE (MOBICOM'01)* (pp. 70-84).

[88] Hu, Y.-C., Perrig, A., & Johnson, D. (2003). Packet leashes: a defense against wormhole attacks in wireless ad hoc networks. In *Proceedings of the INFOCOM' 03* (pp. 1976-1986).

[89] Patwari, N., Hero III, A. O., Perkins, M., Correal, N. S., & O'Dea, R. J. (2003). Relative location estimation in wireless sensor networks. *IEEE Transactions on Signal Processing*, *51*(8), 2137-2148.

[90] Baldauf, M., Dustdar, S., & Rosenberg, F. (2007). A Survey on Context Aware Systems. *International Journal of Ad Hoc and Ubiquitous Computing*, Inderscience Publishers. forthcoming. Pre-print from: http://www.vitalab.tuwien.ac.at/~florian/papers/ijahuc2007.pdf

[91] Hong, D., Chiu, D.K.W., & Shen, V.Y. (2005). Requirements elicitation for the design of context-aware applications in a ubiquitous environment. In *Proceedings of ICEC'05* (pp. 590-596).

[92] Neeraj Tantubay, Dinesh Ratan Gautam and Mukesh Kumar Dhariwal, A Review of Power Conservation in Wireless Mobile Ad hoc Network (MANET)", International Journal of computer Science Issues, Vol 8, Issue 4, No 1, July 2011.

[93] Wenrui Zhao, Mostafa Ammar and Ellen Zegura, "A Message Ferrying Approach for Data Delivery in Sparse Mobile Ad Hoc Networks", *MobiHoc'04,* May 24–26, 2004, Roppongi, Japan.

[94] Sgroi et al., "Designing Wireless Protocols: Methodology and Applications, February 2000.

[95] Gyula et al., "Simulation-based optimization of communication protocols for large-scale wireless sensor networks", 10 October 2002

[96] Rao and Sharma, "Cross Layer Protocols For Multimedia Transmission in Wireless Networks", June 2012

[97] Herms et al, "Realism in Design and Evaluation of Wireless Routing Protocols", 2007.

About Author (s):

Associate Professor Nawaz Mohamudally works at University of Technology, Mauritius (UTM) and has undertaken supervision of MPhil/PhD Students for many years.

M. Kaleem Galamali is a part-time student (achieved M Phil Transfer on 28.10.2014, currently PhD student) at UTM under supervision of A.P. Nawaz Mohamudally.