

Contents

1	Introduction	1
2	Mobility Models in Wireless Access Networks	5
2.1	Investigated Wireless Access Networks	5
2.1.1	Wireless LAN and the IEEE 802.11 Standard	7
2.1.2	Mobile Ad Hoc Networks	9
2.2	Wireless Ad Hoc Access Network Simulation	12
2.3	Mobility Modeling	14
2.3.1	Mobility Model: Definition	15
2.3.2	Survey and Classification of Mobility Models	15
2.4	Requirements for Mobility Models in Network Simulations . . .	20
3	Adaptation of a Simple Model for a Predefined User Distribution	23
3.1	The Pixel Oriented Mobility Model	24
3.2	Calculation of Parameters	26
3.2.1	Adapting to Different Turning Probabilities q_d	31
3.3	Evaluation of the Resulting User Behavior	35
3.3.1	Simulation Setup	35
3.3.2	Simulation Results	37
3.4	Conclusions	41
4	Street-Based Models for Realistic Trajectories	43
4.1	The Basic Models	43
4.1.1	Random Waypoint Mobility Model	44
4.1.2	Random Direction Mobility Model	47

4.2	The City Models	48
4.2.1	Random Waypoint City Model	48
4.2.2	Random Direction City Model	52
4.2.3	The Mobility Model Simulator	55
4.2.4	User Distribution in Steady State	58
4.3	Single Hop Internet Access Using RaWaCi	65
4.3.1	Simulation Setup	65
4.3.2	Access Point Locations	68
4.3.3	Optimization of Access Point Locations	70
4.3.4	Results	73
4.3.5	Conclusion	80
4.4	Controlling the User Distribution of RaDiCi	83
4.4.1	Controlling the User Distribution	84
4.4.2	Implementation Example	90
4.4.3	Conclusion	94
5	Evaluation of Network-Performance-Affecting Mobility Metrics	95
5.1	Investigated Mobility Metrics and Affected Networks	96
5.2	Equalizing the User Distributions of RaWaCi and RaDiCi	96
5.3	Adaptation of Basic Models	98
5.4	Evaluation of Mobility Metrics	101
5.4.1	Speed and Pausing	102
5.4.2	Hotspot Sojourn Time	104
5.4.3	Link Duration and Node Degree	109
5.5	Conclusions	116
6	The Influence of Modeling-Detail	117
6.1	Mobility Model Add-Ons	118
6.1.1	Traffic-Light Simulation	118
6.1.2	Basic Driver Dependence	120
6.1.3	Intelligent Driver Model	121
6.1.4	Open Border Behavior	124

6.2	Simulation Setup and Evaluated Applications	127
6.2.1	Broadcast	131
6.2.2	Constant Bit Rate Traffic Unicast	131
6.2.3	TCP File Transfer	132
6.3	Discussion of Simulation Results	133
6.3.1	Broadcast	133
6.3.2	CBR Connections	138
6.3.3	TCP Connections	139
6.3.4	Open Border Arrival Process	143
6.4	Conclusions	145
7	Conclusions	147
A	Proof of Statement	149
B	List of Acronyms, Symbols and Notation	153
	List of Figures	159
	List of Tables	163
	Bibliography	165