List of Figures

Fig. 1.1 Possible ad hoc networking scenarios and infrastructure integration *11*
Fig. 1.2 Layered reference models (ISO/OSI and Internet) *12*
Fig. 2.1 Overlay lookup example *20*
Fig. 2.2 Spatial prefix distributions as generated by Pastry and DynaMO. Equal symbols and colors represent equal prefixes. *22*
Fig. 2.3 Overlay stretch change over time with Pastry and RLM *23*
Fig. 2.4 Possible cross-layer adaptations at the network layer *26*
Fig. 3.1 GRACE's view of a device's system components [30] *33*
Fig. 3.2 The MobileMAN architecture [35] *35*
Fig. 3.3 The WIDENS architecture [40] *37*
Fig. 4.1 The CrossTalk architecture *45*
Fig. 4.2 Importance of adaptation type vs. timescale *46*
Fig. 4.3 Local View data container *49*
Fig. 4.4 Interactions between the involved components for a notification *50*
Fig. 4.5 Local View interactions *51*
Fig. 4.6 CrossTalk's data dissemination procedure *54*
Fig. 4.7 Stateful dissemination algorithm *56*
Fig. 4.8 Information flow in a layered architecture *58*
Fig. 4.9 Information flow in the various models *59*
Fig. 4.10 Time based weighting functions *60*
Fig. 4.11 Distance based weighting functions *61*
Fig. 4.12 Ad hoc network border effects *62*
Fig. 5.1 Load metric calculation *72*
Fig. 5.2 The load balancing algorithm *74*
Fig. 5.3 Bottleneck node between network partitions *74*
Fig. 5.4 The network core problem *75*
Fig. 5.5 Comparison of the average global and local view over 600 simulated seconds in a typical mobile scenario *78*
Fig. 5.6 Behavior of the global view with a sudden metric decrease *79*
Fig. 5.7 Global view standard deviations in different load scenarios *80*
Fig. 5.8 Global view correctness in scenarios with high churn rates *81*
Fig. 5.9 Global view correctness in networks of different sizes *82*
Fig. 5.10 Load reduction – Average number of packets send per node in differently loaded networks *83*
Fig. 5.11 Average per hop link delay in networks with different topology aspect ratios *84*
Fig. 5.12 Hotspot relief – Maximum packets sent per node in networks of different density *85*
Fig. 5.13 Network wide load balancing effect expressed as the coefficient of variance of the individual nodal loads in scenarios with different traffic patterns (3 hop local) *85*
Fig. 5.14 PDR comparison in networks with different topology aspect ratios *86*
Fig. 5.15 Manhattan mobility map *98*
Fig. 5.16 Freeway mobility map *98*
Fig. 5.17 Correlation between link duration and PDR in Manhattan mobility scenarios *99*
Fig. 5.18 Correlation between link duration and routing overhead in Freeway mobility scenarios *100*
Fig. 5.19 Correlation between link duration and end-to-end delay in RWP mobility scenarios *101*
Fig. 5.20 PDR comparison in RWP mobility scenarios *102*
Fig. 5.21 Routing overhead comparison in RWP mobility scenarios *102*
Fig. 5.22 End-to-end delay comparison in RPGM mobility scenarios *103*
Fig. 5.23 Routing overhead comparison in Freeway mobility scenarios *104*
Fig. 5.24 End-to-end delay comparison in Freeway mobility scenarios *105*
Fig. 5.25 Routing overhead comparison in Manhattan mobility scenarios *105*
Fig. 5.26 End-to-end delay comparison in Manhattan mobility scenarios *106*

Fig. 5.27 Routing overhead across mobility models *107*
Fig. 5.28 Neighborhood hysteresis *112*
Fig. 5.29 Network topology after 50s of simulation *116*
Fig. 5.30 Network topology after 500s of simulation *116*
Fig. 5.31 Dynamic border node detection statistics after 50s simulation *117*
Fig. 5.32 Dynamic border node detection statistics after 500s simulation *118*
Fig. 5.33 Neighbor statistics after 500s for the simple threshold approach *119*
Fig. 5.34 Typical centralized partition detection system structure *120*
Fig. 5.35 Maintenance cost in number of messages sent for the centralized approach during a 500s simulation run *121*
Fig. 5.36 Typical partnerships amongst nodes in the distributed approach *122*
Fig. 5.37 Maintenance cost in number of messages sent for the distributed approach during a 500s simulation run *123*
Fig. 5.38 Partnerships amongst nodes during partitioning *123*
Fig. 5.39 Correlation between network size and the relative error at a fixed cache size of 50% of the number of nodes for different cache replacement strategies *127*
Fig. 5.40 Correlation between network size and the correctness at a fixed cache size of 50% of the number of nodes for different cache replacement strategies *128*
Fig. 5.41 Dependency of the quality of the global view on the index size when using a FIFO replacement strategy in networks of different sizes *129*
Fig. 5.42 Dependency of the uniformity of the global view on the cache size using the FIFO replacement strategy in networks of different sizes *130*
Fig. 5.43 Dependency of the uniformity of the global view on the cache size using the Biggest replacement strategy in networks of different sizes *130*
Fig. 5.44 The impact of churn and the traffic pattern using the FIFO replacement strategy in a 200 node network *131*
Fig. 5.45 Overhead reduction of the stateful data dissemination as opposed the stateless approach *132*
Fig. 5.46 Absolute overhead of both dissemination techniques *133*
Fig. 5.47 Quality of the global view for stateless and stateful data dissemination *133*
Fig. B.1 Overlay stretch of the various Pastry bootstrap mechanisms *150*
Fig. B.2 Total number of messages exchanged during bootstrap (Pastry) *151*
Fig. B.3 Overlay stretch achieved by DynaMO *151*
Fig. B.4 Total number of messages exchanged during bootstrap (Pastry, RLM, CNPA) *152*
Fig. C.1 Interaction between a protocol, the local view and a related data container *153*
Fig. C.2 Interactions during a read access *154*