Properties of the Wireless Medium (2)

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Gliederung

- Grundlagen von IEEE 802.11
- Ad-Hoc Ketten (Chains)
- Ad-Hoc Gitter (Lattice)
  - Zufälliges Netzwerk
- Bewertung von Links
  - Störeinflüsse
- Ansatz zur Verbeserung

Grundlagen von IEEE 802.11

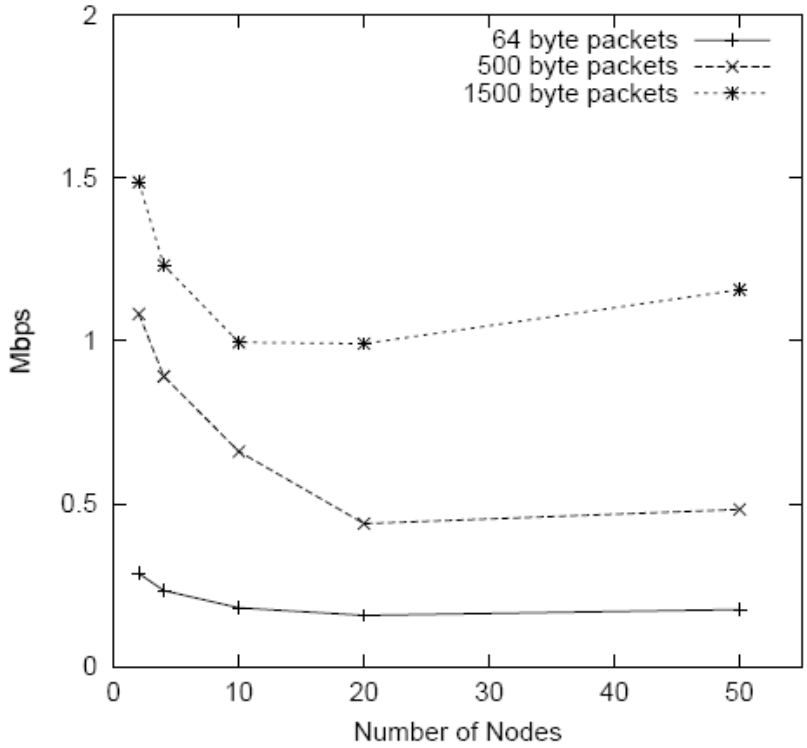

Figure 1: Total network throughput achieved as a function of the number of competing nodes. All nodes are within each others' radio ranges, and all nodes send as fast as 802.11 allows.

Ad-Hoc Ketten (Chains)

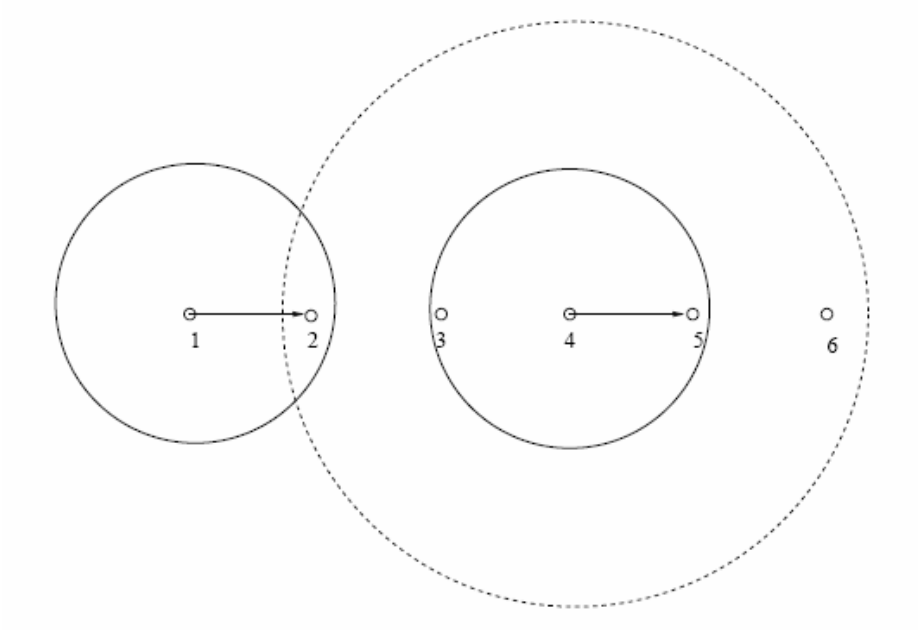

Figure 2: MAC interference among a chain of nodes. The solid-line circle denotes a node's valid transmission range. The dotted-line circle denotes a node's interference range. Node 4's transmission will corrupt node 1's transmissions at node 2.

Ad-Hoc Ketten (Chains)

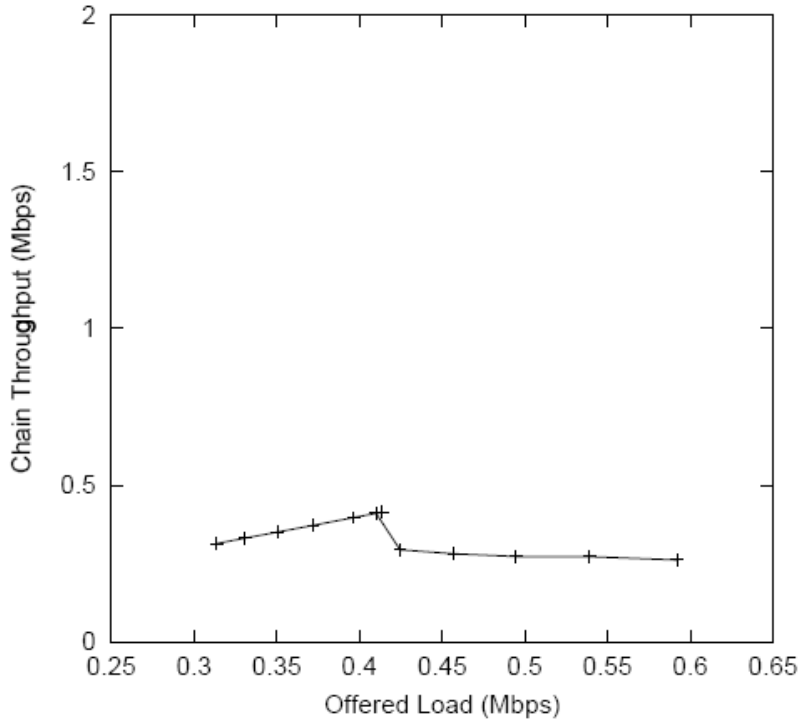

Figure 4: Throughput delivered by an 8-node chain with different send rates, using 1500-byte packets. The fact the peak rate of 0.41 Mbps is not maintained shows the 802.11 MAC does not schedule greedy senders optimally for ad hoc forwarding.

Ad-Hoc Ketten (Chains)

	Node					
	1	**2**	**3**	**4**	**5**	**6**
Send rate	0.48	0.35	0.27	0.26	0.26	0.26
Wasted time (%)	5.4	3.3	3.1	1.5	0	0

Figure 5: Individual node send rates in Mbps, and percent of total time spent in wasted backoff for a 7-node chain, with 1500-byte packets. Note that the 802.11 MAC allows node 1 to send much faster than nodes 2 or 3 can forward, resulting in lost packets.

Ad-Hoc Ketten (Chains)

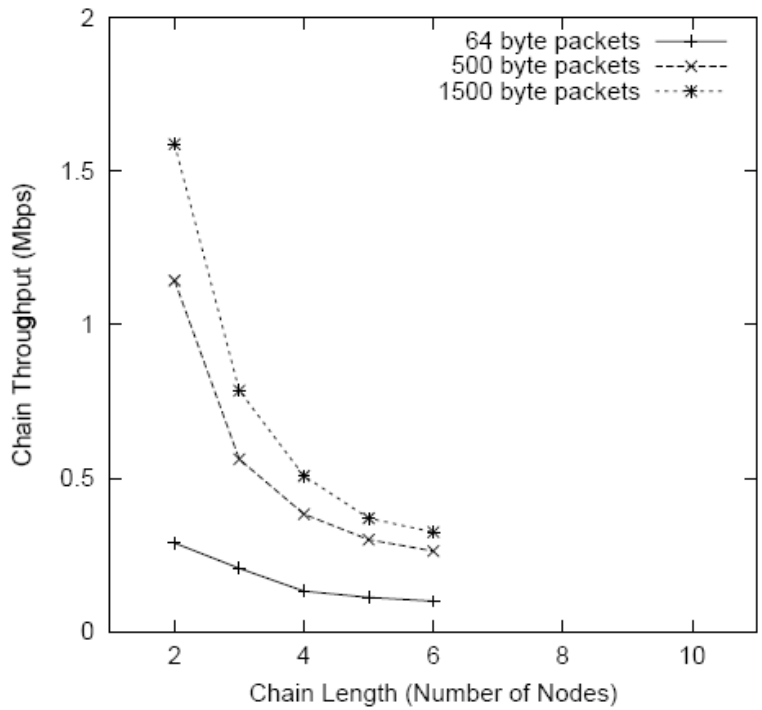

Figure 6: Real hardware throughput achieved along a chain of nodes, as a function of the chain length. Each node was placed at the maximum distance from the previous that allowed low-loss communications. Hardware parameters were set to mimic the simulation parameters as much as possible.

Ad-Hoc Gitter (Lattice)

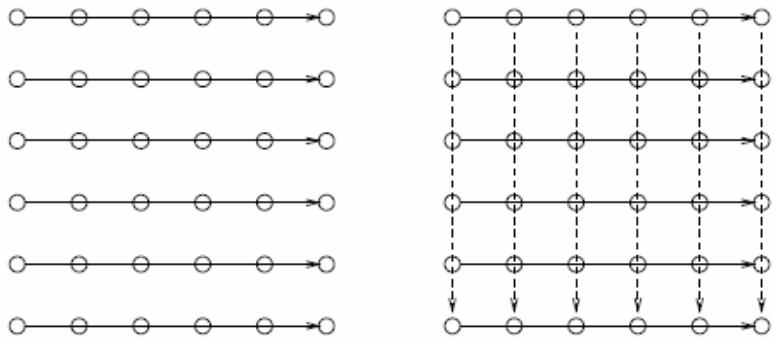

Figure 7: Lattice network topologies, showing just horizontal traffic on the left, and both horizontal and vertical on the right.

Ad-Hoc Gitter (Lattice)

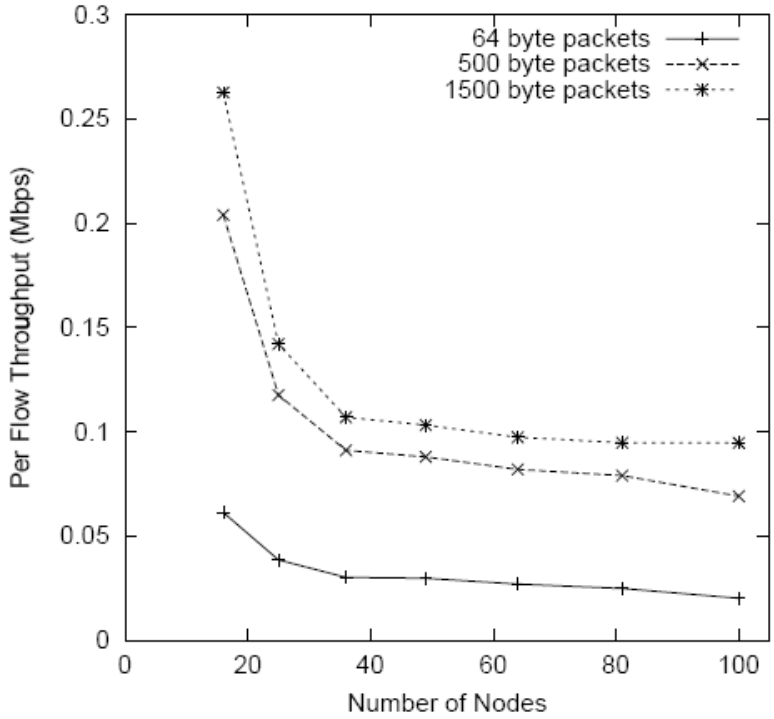

Figure 8: Average per flow throughput in square lattice networks with horizontal data streams only, as a function of network size. There are as many parallel chains as there are nodes per chain. The X axis value is the total number of nodes. Each node is separated from its four neighbors by 200 meters.

Vergleich

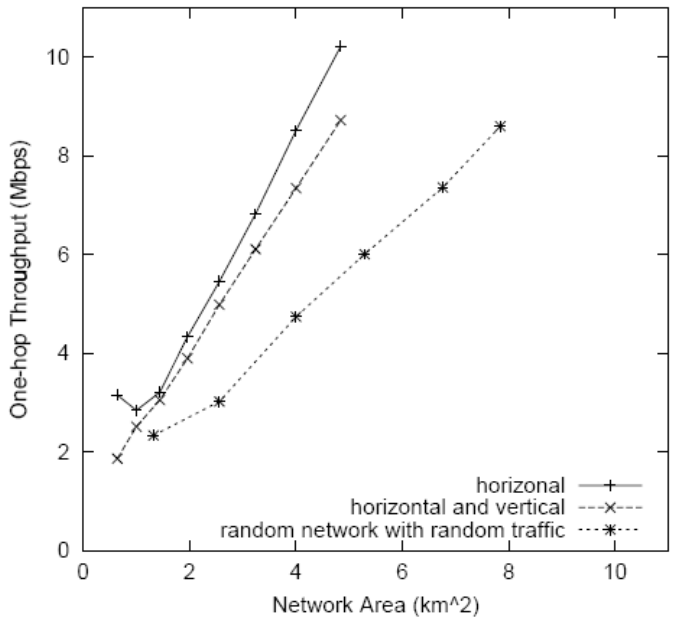

Figure 10: Total one-hop throughput for lattice networks with just horizontal traffic, lattices with both horizontal and vertical traffic, and networks with random node placement and random source-destination pairs. The X axis indicates the network area; the number of nodes is proportional to the area. The Y axis indicates total one-hop throughput measured as the sum total of bits of data sent by all nodes per second, including forwarded bits. The simulations use 1500-byte packets. Note that the total one-hop capacity scales similarly in all three situations.

Zufälliges Netzwerk

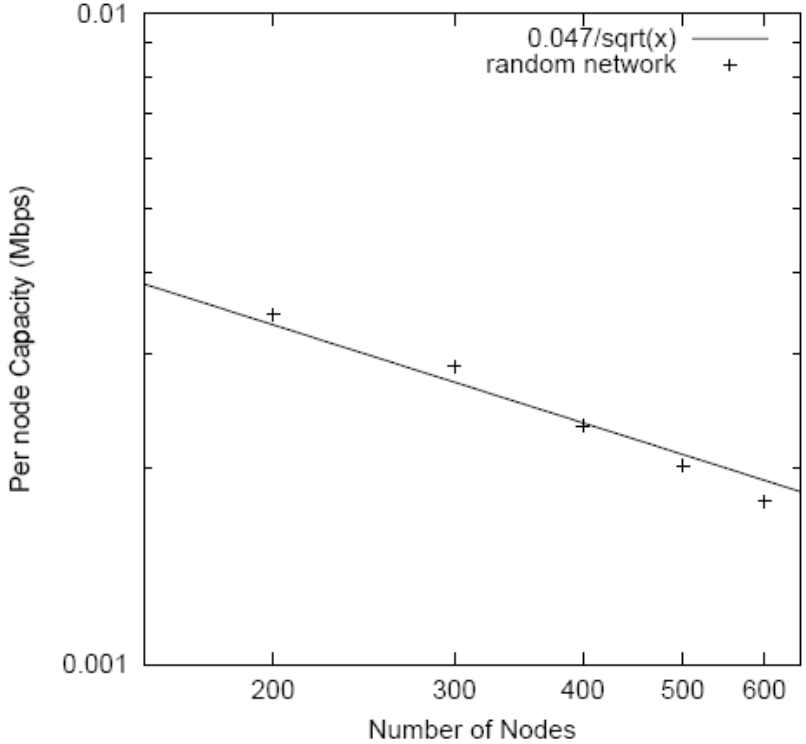

Figure 11: Log scale plot of simulated per node capacity with 1500-byte packets, as the number of nodes grows in a random network, and the fitted $O(1/\sqrt{n})$.

Aufbau BRN

Bewertung von Links

Figure 1: Indoor-Testbed with 14 active nodes.

Bewertung von Links

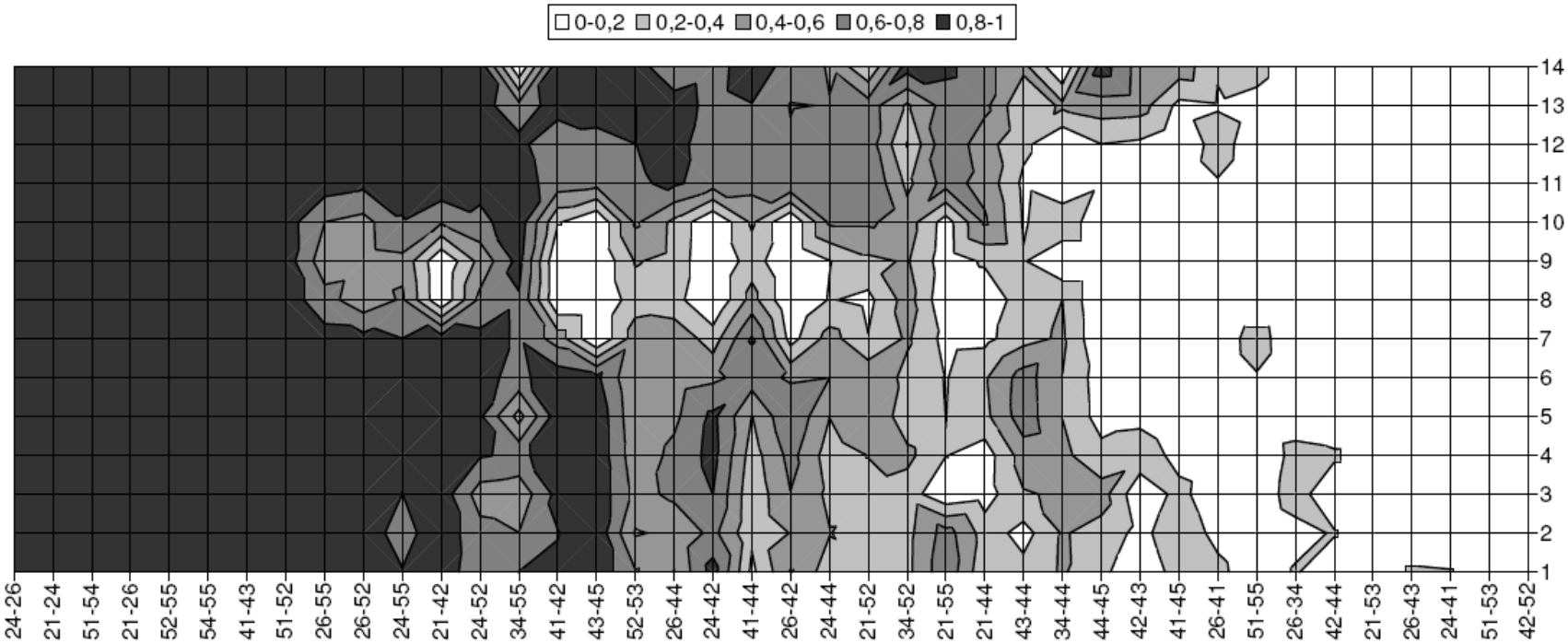

Figure 2: Link Delivery Probability against wireless link and radio channel within the BRN Indoor-Testbed

Bewertung von Links

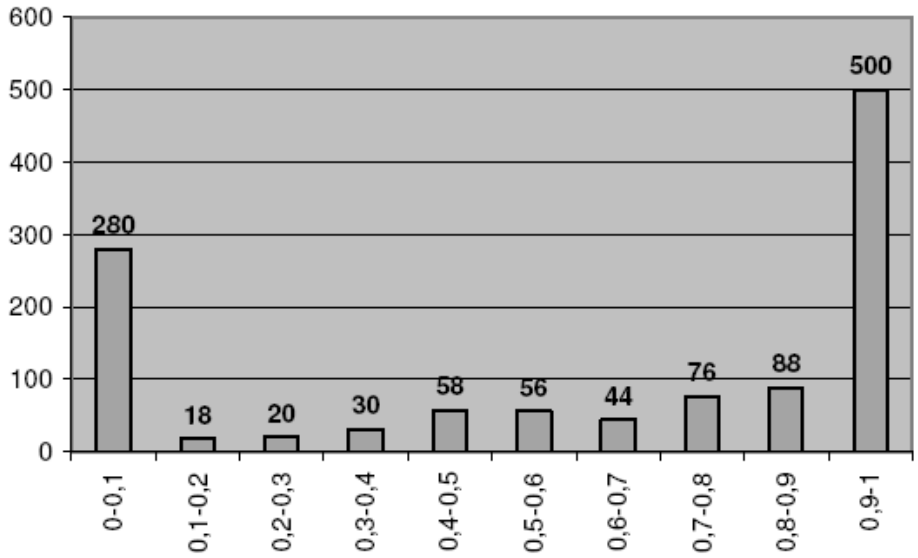

Figure 4: Histogram of Delivery Ratio Symmetry for all links, where defined.

Störeinflüsse

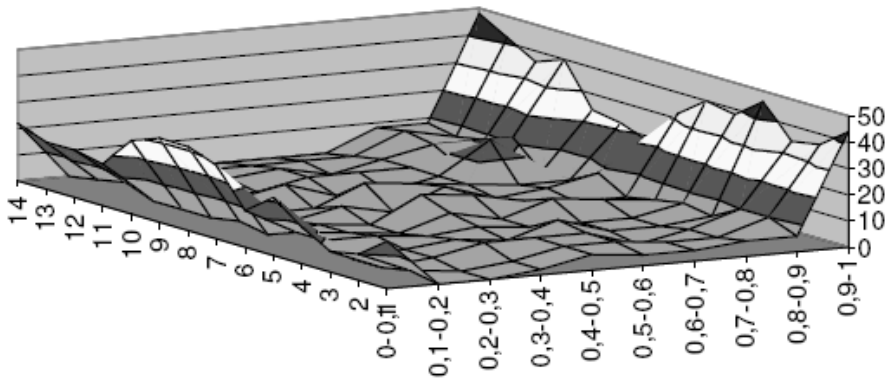

Figure 5: Histogram of Delivery Ratio Symmetry for all links, where defined, in relation to the channel.

Störeinflüsse

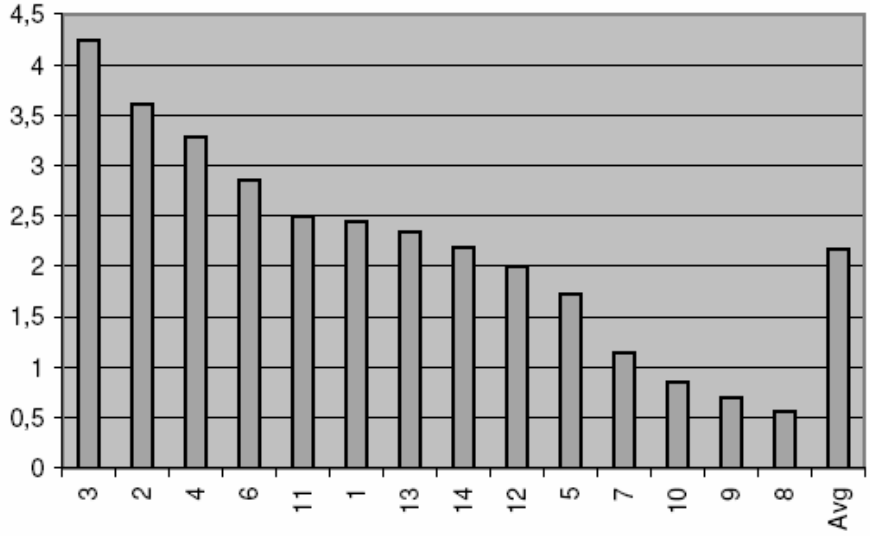

Figure 6: Ratio of very symmetric (dsym in [0.9,1.0]) to very asymmetric (dsym in [0,0.1]) links depending on the used channel.

Störeinflüsse

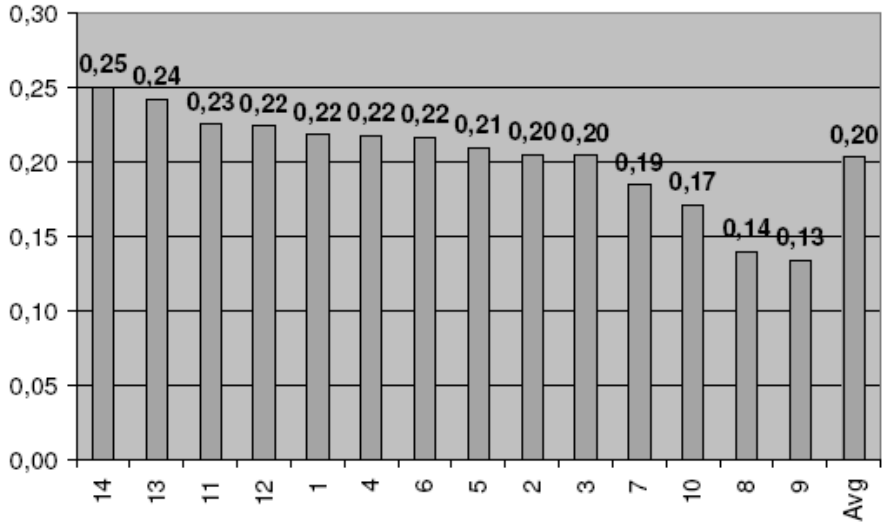

Figure 7: Averaged node delivery ratio for the channels 1 - 14.

besserer Algorithmus

Node	Minimum		Maximum	
	d_n	Channel	d_n	Channel
52	0,28	8	0,41	14
26	0,24	9	0,40	12
55	0,28	9	0,39	12
24	0,23	9	0,37	12
21	0,16	8	0,37	11
44	0,09	9	0,30	14
42	0,00	9	0,28	4
41	0,09	9	0,26	14
43	0,08	10	0,21	14
45	0,00	7	0,17	14
51	0,13	9	0,17	14
54	0,14	2	0,14	13
34	0,07	14	0,14	4
53	0,02	8	0,07	14
Avg	0,13		0,26	

Table 1: Channel assignment maximizing and minimizing the delivery ratio per node, with corresponding channel.

Fragen ?

Diskussion