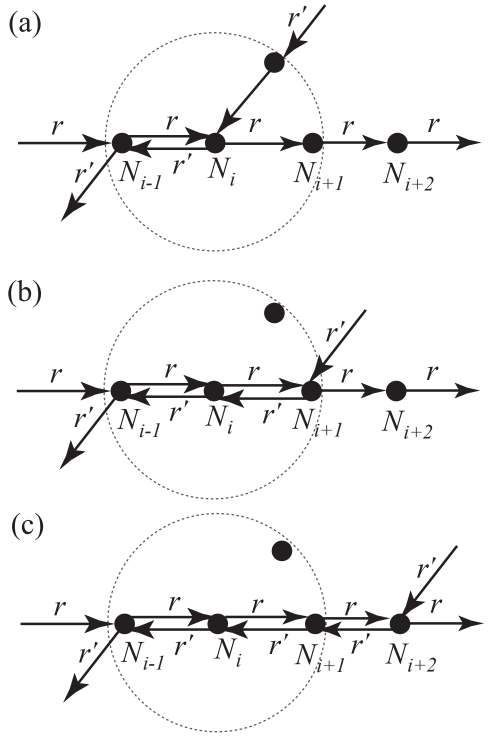

Fig. 8: Capacity Update due to Additional Wireless Transmission Route(7)

IV. Evaluation

In order to evaluate the proposed method in the previous section, we show the results of the simulation experiments in this section. A simulation field is a 700m $\times$ 700m square and 100-130 wireless nodes with a 100m transmission range are randomly distributed due to the unique distribution randomness. A source and a destination wireless nodes are fixed as shown in Figure5, and an initial capacity of each wireless node is determined to be the distance from the center of the simulation field plus 0.1-0.3 randomly determined margin [Mbps]. Based on the depth first search, capacity increasing wireless multihop transmission routes are detected one by one. The totally reserved capacity and the time duration required for the capacity increasing wireless multihop transmission routes are evaluated. The following three methods are compared:

1) Extension of Ford-Fulkerson with the proposed cut-off (Proposal)
2) Extension of Ford-Fulkerson without the proposed cut-off
3) No reverse directional wireless communication links, i.e., wireless multihop transmission routes without joins and branches

TableI shows the reserved capacity by the above three methods. In accordance with the original Ford-Fulkerson method, our proposed extended method for wireless multihop networks in [5] achieves 0.3-1.0% more capacity than the no reverse directional wireless communication method. In addition, the proposed cut-off method does not affect the achieved capacity, i.e., only reduction of 0.0-0.14% of reserved capacity.

TABLE I: RESERVED CAPACITY IN SIMULATION EXPERIMENTS .

Number of Nodes	Reserved Capacity		
	(1)	(2)	(3)
100	0.3261	0.3261	0.3249
110	0.3888	0.3893	0.3848
120	0.4367	0.4372	0.4337
130	0.4756	0.4757	0.4719

TABLE II: REQUIRED TIME DURATION IN SIMULATION EXPERIMENTS.

Number of Nodes	Required Time Duration		
	(1)	(2)	(3)
100	0.29	1.02	1.27
110	2.46	56.80	90.77
120	27.62	127.04	153.26
130	177.31	762.19	961.31

TableII shows the required time duration for detection of multiple capacity increasing wireless multihop transmission routes in simulation experiments. The proposed method requires only 4.3-23.3% time duration in comparison with the other two methods. Hence, the cut-off does not reduce the reserved capacity so much and the required time duration is considerably reduced.

V. Concluding Remarks

This paper proposes an extension of Ford-Fulkerson algorithm for reservation of capacity of a set of wireless multihop transmission routes with joins and branches. Here, the purpose is not for achieving the maximum capacity but for reservation of the required capacity, the cut-off method for search is introduced and is expected to reduce the required time duration. As expected, very little reservation capacity is lost but considerably required time duration is reduced.

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