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#1569419857: *Sum Degrees-of-Freedom of Two-Unicast Wireless Networks*

Property	Change Add	Value				
Conference and *track*		**2011 IEEE International Symposium on Information Theory** - *2011 IEEE International Symposium on Information Theory*				
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Presenter		presenter not specified				
Registration	+					
Category		Eligible for ISIT Student Paper Award				
Title		*Sum Degrees-of-Freedom of Two-Unicast Wireless Networks*				
Abstract		THIS PAPER IS ELIGIBLE FOR THE STUDENT PAPER AWARD We consider two-source two-destination (i.e., two-unicast) multi-hop wireless networks that have a layered structure with arbitrary connectivity. We show that, with probability 1 over the choice of the channel gains, two-unicast layered Gaussian networks can only have 1, 3/2 or 2 sum degrees-of-freedom. We provide necessary and sufficient conditions for each case based on the network connectivity and a new notion of source-destination paths with manageable interference.				
Keywords		two-unicast; wireless networks; degrees-of-freedom				
Topics		Multiple terminal information theory; Network communication theory				
Session		The program is not yet visible (tpc)				
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Review manuscript		**Document (show)**	**Pages**	**File size**	**Changed**	**MD5**	**Similarity score**
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Final manuscript	⤴	Can upload 5 pages until May 31, 2011 00:00:00 EDT.

Personal notes

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Reviews

You are a TPC member for this conference.

3 Reviews

Review 1 (Reviewer C)

Importance	Technical Level	Novelty	Presentation	Recommendation
Very Important (4)	Good technical level (4)	Very Novel (4)	Good (4)	Strongly Recommend (5)

Strengths (What are the key strengths of this paper?)
The paper categorizes all possible connectivity patterns for two-unicast layered wireless networks and provides new achievable schemes and outer bounds to characterize the sum degrees of freedom of the network. These are highly non-trivial and the results are interesting and important.

Weaknesses (What are the major weaknesses of this paper?)
The writing can be made more intuitive, especially for the outer bound proofs. It would be good to give some intuition of how the outer bounds are derived.

Comments and Recommendation (Please give the reasoning for your overall recommendation and any additional comments you wish to add.)

The paper only considers real constant channel coefficients. It seems that the results can be applied to complex constant channels as well. Please comment.

Review 2 (Reviewer E)

Importance	Technical Level	Novelty	Presentation	Recommendation
Extremely Important (5)	Good technical level (4)	Very Novel (4)	Room for improvement (2)	Strongly Recommend (5)

Strengths (What are the key strengths of this paper?)

This paper studies the problem of two-unicast multi-hop wireless network. Unlike the single-unicast or multi-cast netowrks, the exact and even approximate capacity region characterization is not known for this problem. This work provides an importance result which claims a general characterization in terms of DoF for a large class of networks (namely, layered networks). All networks in such class are categorized in different groups based on the topology of the underlying graph, and the total DoF is characterized for each category.

Weaknesses (What are the major weaknesses of this paper?)

There is a lot of room to improve the presentation of the paper. In fact without referring to the long version [21], it is impossible to follow the arguments. Some examples/figures would be very helpful to illustrate the ideas/concepts, e.g., construction of the condensed network in Fig 1 is not clear until page 3. I would suggest the authors to try to explain the techniques through some examples instead of formally prove them. Specially, toy examples can be used for achievability arguments. The proofs have to be followed, anyway, through the complete version available on arxiv!

Comments and Recommendation (Please give the reasoning for your overall recommendation and any additional comments you wish to add.)

Minor comments:

-There are a few technical typos in the proofs which have to be fixed for the final version, e.g., (i) W_1 in the last conditional entropy in the first line of (1) should be W_2; (ii) Wherever Fano's inequality is used ϵ_n has to be replaced by $n \epsilon_n$ (otherwise it does not tend to zero); etc.

-Can you comment on the role of power adjustment parameter in page 2? Why such restriction is only applied to the source nodes but not the relay nodes?

Student Paper Award (This paper is eligible for the student paper award. Do you think it would rank among the top ten papers out of the 500 submitted papers in that category? If so, explain why.)

Given the importance of the problem studied in this work and the nice result presented, I would like to recommend this work to be considered as a candidate for the best student paper award, after a major revise in the presentation of the paper.

Review 3 (Reviewer B)

Importance	Technical Level	Novelty	Presentation	Recommendation
Very Important (4)	Good technical level (4)	Average Novelty (3)	Excellent (5)	Strongly Recommend (5)

Strengths (What are the key strengths of this paper?)

The result on the layered two-unicast is quite interesting. The fact that the sum dof is either 1, 3/2, or 2 depending on the topology of the network is not quite obvious.

Weaknesses (What are the major weaknesses of this paper?)

The result of the paper is restricted to the layered networks. A similar result for general networks would be a significant addition to the paper.

1 Summary review by TPC member

Review 1 (Reviewer A)

TPC recommendation

Strong accept (5)

TPC Recommendation Justification (Please give a justification for your recommendation, especially if the review scores vary widely or your recommendation differs significantly from those of the reviewers.)

This is a nice and timely paper which considers the two users-two destinations unicast problem, and manages in a very nice way to characterize in full the associated DoF. This is a highly non-trivial and interesting result.
It would enhance the contribution significantly, if indeed the authors are able to address more general networks, or at least also complex and not only real channel coefficients. As for the final ISIT2011 paper, it is strongly suggested to include examples as to illuminate the central ideas, while details of the rigorous proofs may be left, for space considerations, to the full paper version [21].

I definitely recommend this submission decisively.

Student Paper Award (This paper is eligible for the student paper award. The TPC needs to identify 10-15 semifinalists for the award from among the 500 submitted eligible papers. Later the IT Society Awards

committee will select up to three winners. If you think this paper is worthy of the award, please send a one page nomination to the TPC cochairs at isit2011@eng.tau.ac.il with "STUDENT AWARD NOMINATION" in the subject header. The TPC co-chairs and IT Society Awards committee will have access to the papers, reviews (including your TPC summary review) and the nominations of the finalists. (You need not write anything in the box here.))

This is a highly non-trivial original contribution, which has received the highest appreciation of three expert reviewers, as well as myself.
I definitely recommend to consider this submission for the student paper award.

Discussion