

Assignment: Survey of a Wireless Networking Topic

18-759 Wireless Networking, Spring 2010

For this assignment, you must prepare a survey of particular topic in the area of wireless networking. A list of possible topics is given below. For each topic we have identified a set of initial papers that can be used to explore the topic. This project will be done in teams of 2 students.

What is a survey?

The goal of a survey is to give a broad, structured overview of a specific area. Here are two scenarios in which you may have to prepare a survey after you graduate:

- You are working for a company that is exploring a new wireless technology or market, so employees and management are very not very familiar with this new area. You could be asked to prepare a 30 minute presentation to introduce to area, highlighting different approaches, challenges, opportunities, and risks.
- You decided to go to graduate school and you are writing your first paper on a research project you just finished. You need to write a short related work section that includes a survey of existing work in the areas relevant to your research.

A survey is different from a set of paper summaries. The survey should focus on presenting the “big picture” using the papers as examples. For each topic, we have identified about three papers to get you started, but we generally expect that you will have to consult additional materials. Examples may be papers cited in the original papers, material found on the web, or results from online libraries, like IEEE Explorer, or the ACM portal.

Besides giving you experience in preparing a survey, this assignment should also help you sharpen your critical thinking skills. You should not blindly accept all statements you read (including in the papers cited below) simply because they appear in print in a refereed publication. While the material will generally be technically correct, parts of the papers may be biased or may ignore relevant related work (typically by accident), or the claims may overstate the results that are presented. These problems most often show up in the evaluation section of the papers. The evaluation is sometimes flawed (e.g. uses inaccurate simulators, ignores certain sources of overhead, or presents graphs in misleading ways) or may be very limited in scope (e.g. collects results on one testbed that may not be typical, but then makes very broad claims). Your assessment of the accuracy of the results should be reflected in the survey, i.e. the survey must present your perspective on the state of the art in the area.

You can consult pretty much any material as long as you cite the source. However, you cannot copy text from other papers or the web, since that is plagiarism. The only exception is that you can quote short excerpts or figures from other material, assuming you make it clear that it is a quote and you cite the source.

Deliverables

You specifically have two deliverables for this assignment:

- You should prepare a 20 minute presentation. We will allocate 30 minute slots after the mid-term break, leaving time for questions after each presentation.
- You should present a written version of your survey. The length should be limited to 800 words (about 2 pages), not including references.

The first step is to form teams of two students; exceptions in team size need to be approved by the instructor. Each team should propose three rank-ordered topics. The instructors will then assign topics to teams, considering the relevance of topics, their breadth and diversity. One of the three topics you list can be self defined, i.e. you can pick a topic that is not on the list. For self-defined topics, you must provide the initial set of papers that you propose to use as the starting point for the core.

Please e-mail your team information and preferred topics to both instructor using the Subject “team information 18-759 surveys” by Monday Feb 16. You should similarly e-mail your rank-ordered list of preferred topics by Friday Feb 20.

Milestones

	Milestone	Comment
Monday Feb 22	Submit team information	2students per team
Friday Feb 26	List of proposed topics due	
Wednesday Mar 5	Instructors announce topics	
March – April	In class presentations	
10 days before your presentation	Submit draft slides for feedback from instructors	Earlier is always better
Wednesday April 28	Survey documents due	

Topics

We list example topics with an initial set of papers for each topic. For some papers, you need a CMU IP address to access the paper, i.e. you need to be on campus or use a tunnel.

1. Ad hoc networking

- [GPSR: Greedy Perimeter Stateless Routing for Wireless Networks](#), Proc. 6th Annual International Conference on Mobile Computing and Networking (MobiCom 2000).
- ✓ [DSR: The Dynamic Source Routing Protocol for Multi-Hop Wireless Ad Hoc Networks](#). In Ad Hoc Networking, edited by Charles E. Perkins, Chapter 5, Addison-Wesley, 2001.
- [Ad hoc On-Demand Distance Vector Routing](#). Proc. of the 2nd IEEE Workshop on Mobile Computing Systems and Applications, New Orleans, LA, February 1999.

2. Mesh networking

- [Trading Structure for Randomness in Wireless Opportunistic Routing](#), ACM Sigcomm 2007
- ✓ [ExOR: Opportunistic Multi-Hop Routing for Wireless Networks](#), ACM Sigcomm 2005
- [Simple Opportunistic Routing Protocol for Wireless Mesh Networks](#), IEEE WiMesh 2006

3. WiFi on the move

- [Understanding WiFi-based Connectivity From Moving Vehicles](#), IMC, October 2007
- [Cabernet: Vehicular Content Delivery Using WiFi](#), Mobicom 2008
- ✓ [Interactive WiFi Connectivity for Moving Vehicles](#), ACM Sigcomm 2008

4. 802.11 rate adaptation

- ✓ [Efficient channel-aware Rate Adaptation in Dynamic Environments](#), ACM Mobisys 2008
- [CARA: Collision-Aware Rate Adaptation for IEEE 802.11 WLANs](#). IEEE INFOCOM 2006
- [Robust rate adaptation for 802.11 wireless networks](#), ACM Mobicom 2006

5. Measurements of wireless networks

- ✓ [A Measurement Study of a Commercial-grade Urban WiFi Mesh](#), IMC 2008
- [Analysis of a mixed-use urban wifi network: when metropolitan becomes neapolitan](#), IMC 2008
- [Experimental Characterization of Home Wireless Networks and Design Implications](#), In IEEE Infocom 2006

6. TCP over wireless

- [Horizon: Balancing TCP over Multiple Paths in Wireless Mesh Network](#), Mobicom 2008

- ✓ [A Comparison of Mechanisms for Improving TCP Performance over Wireless Links](#), ACM Sigcomm 1996
- [An Internet-style Approach to Wireless Link Errors](#)" Journal of Wireless Communications and Mobile Computing, Wiley, special issue on "Reliably Transport Protocols for Mobile Computing", Volume 2, Number 1, February 2002, pages 21-35.
- [Performance of TCP in Multi-Hop Access Networks](#), IEEE IWQoS 2008, June 2008.

7. Disruption Tolerant Networking – DTN

- ✓ [A delay-tolerant network architecture for challenged internets](#), ACM Sigcomm 2003
- [A Message Ferrying Approach for Data Delivery in Sparse Mobile Ad Hoc Networks](#), ACM Mobicom 2004
- [Low-Cost Communication for Rural Internet Kiosks Using Mechanical Backhaul](#), MobiCom 2006.
- [DTN Routing as a Resource Allocation Problem](#), ACM SIGCOMM 2007

8. WiFi network design and planning, and self-tuning MAC

- [Optimal Design of High Density 802.11 WLANs](#), CoNEXT 2006
- [MDG: Measurement-Driven Guidelines for 802.11 WLAN Design](#), In ACM Mobicom 2007
- ✓ [Assessment of Urban-Scale Wireless Networks with a Small Number of Measurements](#), Mobicom 2008

9. Vehicular networks

- [A-STAR: A Mobile Ad Hoc Routing Strategy for Metropolis Vehicular Communications](#), Networking 2004
- ✓ [Conditional Transmissions: Performance Study of a New Communication Strategy for VANET](#), IEEE Transactions on Vehicular Technology, 2007.
- [Local Density Estimation and Dynamic Transmission-Range Assignment in Vehicular Ad Hoc Networks](#), IEEE Transactions on Intelligent Transportation Systems, 2007.

10. Dynamic spectrum access

- Spectrum measurements: <http://www.sharedspectrum.com/measurements/> Pick any report and possibly compare reports from different locations.
- ✓ [NeXt generation dynamic spectrum access/cognitive radio wireless networks, survey](#), Computer Networks, Elsevier, 2006.
- [DSAP: A Protocol for Coordinated Spectrum Access](#), IEEE DySPAN 2005.
- [Distributed coordination in dynamic spectrum allocation networks](#), IEEE DySPAN 2005

11. Network coding

- [ZigZag Decoding: Combating Hidden Terminals in Wireless Networks](#), ACM Sigcomm 2008
- [Symbol-level Network Coding for Wireless Mesh Networks](#), ACM Sigcomm 2008
- ✓ [Beyond the Bits: Cooperative Packet Recovery Using PHY Information](#), Mobicom 2007
- [Improving Loss Resilience with Multi-Radio Diversity in Wireless Networks](#), ACM Mobicom 2005

12. Opportunistic Communication

- ✓ [Design and Implementation of an Efficient Opportunistic Retransmission Protocol](#), unpublished draft.
- [ExOR: opportunistic multi-hop routing for wireless networks](#), ACM SIGCOMM 2005.
- [Cooperative Diversity in Wireless Networks: Efficient Protocols and Outage Behavior](#), IEEE Trans. Inf. Theory, Dec 2004.

13. Wireless Simulation and Emulation

- [On the accuracy of manet simulators](#). David Cavin, Yoav Sasson, and André Schiper, Workshop on Principles of Mobile Computing (POMC'02), pages 38-43. ACM, October 2002.
- ✓ [Experimental evaluation of wireless simulation assumptions](#). David Kotz and Calvin Newport and Robert S. Gray and Jason Liu and Yougu Yuan and Chip Elliott. Technical Report TR2004-507, Dept. of Computer Science, Dartmouth College, June, 2004.
- [Repeatable and Realistic Wireless Experimentation through Physical Emulation](#), Glenn Judd and Peter Steenkiste, HotNets-II, ACM, November 2003.
- ["Overview of the ORBIT Radio Grid Testbed for Evaluation of Next-Generation Wireless Network Protocols"](#), D. Raychaudhuri, I. Seskar, M. Ott, S. Ganu, K. Ramachandran, H. Kremo, R. Siracusa, H. Liu and M. Singh, To appear at the Wireless Communications and Networking Conference (WCNC'05) March 2005.

14. TV White Spaces

- [NPRM 04-186: Unlicensed Operation in the TV Broadcast Bands](#), focus on pages 1-14.
- [IEEE 802.22: An Introduction to the First Wireless Standard based on Cognitive Radios](#), Cordeiro, Challapali, Birru, Journal of Communications, Vol 1, No 1, April 2006.
- ✓ [White space networking with wi-fi like connectivity](#), Bahl, Chandra, Moscibroda, Murty, and Welsh, SIGCOMM 2009.
- [A Hardware Platform for Utilizing TV Bands with a Wi-Fi Radio](#), Narlanka, Chandra, Bahl, and Ferrell, 15th IEEE Workshop on Local and Metropolitan Area Networks, 2007: optional reading on the radio used in previous paper.

15. Channel-aware optimization

- [Design, implementation and evaluation of an efficient opportunistic retransmission protocol](#), Amy Lu, Peter Steenkiste, Tsuhan Chen, ACM MobiCom 2009.
- [Efficient channel-aware rate adaptation in dynamic environments](#), Glenn Judd, Eeyore Wang, Peter Steenkiste, ACM MobiSys 2008.
- [Interference-Aware Transmission Power Control for Dense Wireless Networks](#), Xi Liu, Srinu Seshan, and Peter Steenkiste, Proceedings of the Annual Conference of ITA, College Park, MD, September 2007.
- ✓ ([DIRC: Increasing Indoor Wireless Capacity Using Directional Antennas](#), Xi Liu, Anmol Sheth, Michael Kaminsky, Konstantina Papagiannaki, Srinivasan Seshan, Peter Steenkiste, ACM Sigcomm 2009. – dropped)

16. Diagnostics

- [RFDump: An Architecture for Monitoring the Wireless Ether](#), Kaushik Lakshminarayanan, Samir Sapra, Srinivasan Seshan, Peter Steenkiste, ACM CoNEXT 2009
- ✓ [MOJO: a distributed physical layer anomaly detection system for 802.11 WLANs](#), Sheth, Doerr, Grunwald, Han, Sicker, ACM MobiSys 2006.
- [Jigsaw: Solving the Puzzle of Enterprise 802.11 Analysis](#), Y-C Cheng, J. Bellardo, P. Benko, A. Snoeren, G. Voelker, and S. Savage, ACM SIGCOMM, September 2006.

17. Conflict graphs

- [Online estimation of RF interference](#), N. Ahmed, U. Ismail, S. Keshav, and K. Papagiannaki, ACM CoNext 2008.
- ✓ [Maximizing Spatial Reuse in Dense Wireless Networks](#), Xi Liu, Srinu Seshan, Peter Steenkiste, draft
- [CENTAUR: Realizing the Full Potential of Centralized WLANs through a Hybrid Data Path](#), Vivek Shrivastava, Nabeel Ahmed, Shravan Rayanchu, Suman Banerjee, Srinivasan Keshav, Konstantina Papagiannaki, and Arunesh Mishra, ACM MobiCom 2009

18. Spectrum Coordination

- [Global Control Plane Architecture for Cognitive Radio Networks](#), Jing and Raychaudhury, IEEE ICC 2007.
- [Distributed Rule Regulated Spectrum Sharing](#), Lili Cao and Heather Zheng, IEEE JSAC, January 2008.
- ✓ [Demand Responsive Pricing and Competitive Spectrum Allocation via a Spectrum Server](#), Ileri, Samardzija, and Mandayam, IEEE Dyspan, 2005.

19. Load balancing in 802.11

- ✓ [Load-Aware Spectrum Distribution in Wireless LANs](#), ICNP 2008

- [Cell breathing in wireless LANs: Algorithms and Evaluation](#), IEEE Transactions on Mobile Computing 2006
- [Fairness and load balancing in wireless LANs using association control](#), International Conference on Mobile Computing and Networking 2004