Assignment: Survey of a Wireless Networking Topic
18-452/750 Wireless Networking, Spring 2024

For this assignment, teams of 2 students 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.

What is a survey?

The goal of a survey is to give a broad, structured overview of a specific area. Here are two example 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 presentation of 15-20 minutes (depending on class size) to introduce a topic, describe different approaches, challenges, risks, and opportunities.

- 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 summary of a set of papers. Instead, think of it as a short lecture that introduces a topic to an audience with a (conveniently) shared background corresponding to the material presented in the course. The survey should focus on presenting the "big picture" using the papers as examples. For each topic, we have identified three papers to get you started, but we generally expect that you will have to consult additional material. 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., a paper that makes broad claims only presents results on one testbed that may be atypical). 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

Teams of two students should prepare a 15-20 minute presentation (incuding questions), with an additional 10 minutes for Q&A. Staying within your time slot is hard but it is an important skill, so you should plan to practice your survey presentation. The surveys will start after spring break.

The first step is to propose three rank-ordered topics. The instructors will then assign a topic to each team, 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 rank-ordered list of topics to the instructor by March 9.

Milestones

First half of the semester:

	Milestone	Comment
Fr, Feb 23	Team info and list of topics due	E-mail to instructor
Before Springbreak	Instructor announce topics	
Week of Apr 15	Surveys presentations	Details on course schedule

In the weeks before your survey:

	Milestone	Comment
14 days before survey	Submit draft slides to instructor for feedback	Hard deadline.
Within a week	Meet with instructor for feedback (if needed)	Scheduled time
3 days before survey	New draft for feedback	Earlier is better
9am morning of survey	Submit slides for posting	

Topics Spring 2022

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 VPN.

Wireless technologies

1. **Never versions of WiFi**

- [IEEE 802.11ah: A Long Range 802.11 WLAN at Sub 1 GHz](#), Journal of ICT Standardization, Vol 1, 2013.

- [IEEE 802.11af: A Standard for TV White Space Spectrum Sharing](#) , IEEE Communications Magazine, Oct 2013

- [IEEE 802.11ax: High-Efficiency WLANs](#) , IEEE Wireless Communications, Dec 2015.

- ✓ [White paper 802.11ax](#), Aruba

- ([IEEE 802.11ay: Next-Generation 60 GHz Communication for 100 Gb/s WiFi](#)), IEEE Communications Magazine, Dec 2017) Not included in survey

2. **Low power wireless**

- ✓ [Charm: Exploiting Geographical Diversity Through Coherent Combining in Low-Power Wide-Area Networks](#), IPSN 2018

- [Challenge: Unlicensed LPWANs Are Not Yet the Path to Ubiquitous Connectivity](#), Mobicom'19

- [Understanding Power Consumption of NB-IoT in the Wild: Tool and Large-scale Measurement](#). Mobicom 2020

3. **Visible Light Communication**

- ✓ [Indoor Optical Wireless Communication: Potential and State-of-the art](#), IEEE Communications Magazine, Sep 2011.

- [Indoor Positioning Based Visible Light Communication: A Performance-based Survey of Real-world Prototypes](#), ACM Computing Surveys, Vole, No 2, 2019 (sections 1-4)

- [Enabling Vehicular Visible Light Communication (V2LC) Networks](#), ACM Vanet 2011

4. **Backscatter and Ambient Communication**

- [Ambient Backscatter: Wireless Communication Out of Thin Air](#), ACM Sigcomm 2013

- ✓ [Pushing the Range Limits of Commercial Passive RFIDs](#), NSDI 2019

- [Underwater backscatter networking](#), Sigcomm 2019

5. **Sensing with WiFi**

- ✓ [Smart Homes that Monitor Breathing and heart rate](#), CHI 2015

- On the feasibility of Wi-Fi based material sensing, ACM Mobicom 2019
- Toward Low Cost Soil Sensing Using Wi-Fi, ACM Mobicom, 2019

6. 5G – Millimeter wave

- ✓ 802.11ad: Directional 60GHz Communication for Multi-Gbps WiFi , IEEE Communications Magazine, Dec 2014
- A First Look at 802.11ad Performance on a Smartphone, ACM mmNets'19
- Demystifying Millimeter-Wave V2X: Towards Robust and Efficient Directional Connectivity Under High Mobility, ACM Mobicom 2020

7. Wireless security

- ✓ Geo-fencing: Confining Wi-Fi coverage to physical boundaries, International Conference on Pervasive Computing, 2005, Springer.
- A Deep Learning Approach to IoT Authentication, ICC 2018
- Ghostbusters: Detecting the Presence of Hidden Eavesdroppers, Mobicom 2018

8. Vehicular Edge offloading and

- CloudSLAM: Edge Offloading of Stateful Vehicular Applications, SEC 2020
- RAVEN: Improving Interactive Latency for the Connected Car, Mobicom 2018
- ✓ Vehicular Cloud Computing through Dynamic Computation Offloading, Computer Communications, 2018

9. User experience on mobile devices

- Edge Assisted Real-time Object Detection for Mobile Augmented Reality, Mobicom 2019
- AMP up your Mobile Web Experience: Characterizing the Impact of Google's Accelerated Mobile Project, Mobicom 2019
- ✓ NutShell: Scalable Whittled Proxy Execution for Low-Latency Web over Cellular Networks, Mobicom 2017

10. The Internet in the sky

- ✓ Internet Backbones in the Space, CCR 2020
- Delay is Not an Option: Low Latency Routing in Space, HotNets 2018
- BGP-S: a protocol for terrestrial and satellite network integration in network layer, Wireless Networks, Springer, 2004

11. LTE

- [A High Performance Packet Core for Next Generation Cellular Networks](#), ACM Sigcomm 2017
- ✓ [MobileInsight: Extracting and Analyzing Cellular Network Information on Smartphones](#), Mobicom'16
- [An Active-Passive Measurement Study of TCP Performance over LTE on High-speed Rails](#), Mobicom 2019

12. C2V networking

- ✓ [DAZL: Density-Aware Zone-based Packet Forwarding in Vehicular Networks](#), 2012 IEEE Vehicular Networking Conference.
- [A reliable geocast routing protocol for vehicular ad hoc networks](#), Springer, 2015
- [Infrastructure-based Networking for Autonomous Transportation Systems Using IEEE 802.11p](#), IEEE VNC 2019

13. Spectrum auctions

- ✓ [Auction Approaches for Resource Allocation in Wireless Systems: A Survey](#), IEEE Communications Surveys and Tutorials, 2013 (sections I-III only)
- [Spectrum Auction Design](#), Review of Industrial Organization, 2013.
- [Enabling Spectrum Sharing in Secondary Market Auctions](#), IEEE Transactions on Mobile Computing, 2014.

14. MIMO (papers will change)

- ✓ [Full Duplex MIMO Radios](#), NSDI 2014
- [JMB: Scaling Wireless Capacity with User Demands](#), ACM Sigcomm 2012
- [The Case for UHF-Band MU-MIMO](#), ACM Mobicom 2014

15. Localization

- [CEASAR: Carrier Sense Ranging in Off-the-Shelf 802.11 Wireless LAN](#), ACM CoNext 2011
- ✓ [No Need to War-Drive: Unsupervised Indoor Localization](#), Mobisys 2012
- [Accurate Indoor localization with zero start-up cost](#) , ACM Mobicom 2014

16. 5G deployments

- R. Riggio, M. K. Marina, J. Schulz-Zander, S. Kuklinski and T. Rasheed, "Programming Abstractions for Software-Defined Wireless Networks," IEEE Transactions on Network and Service Management, Vol. 12, No. 2, 2015.

- X. Foukas, N. Nikaein, M. M. Kassem, M. K. Marina and K. Kontovasilis, "FlexRAN: A Flexible and Programmable Platform for Software-Defined Radio Access Networks," ACM CoNEXT, 2016.

- X. Foukas, M. K. Marina and K. Kontovasilis, "Orion: RAN Slicing for a Flexible and Cost-Effective Multi-Service Mobile Network Architecture," ACM MobiCom, 2017

- M. Kassem, M. Kheirkhah, M. K. Marina and P. Buneman, "WhiteHaul: An Efficient Spectrum Aggregation System for Low-Cost and High Capacity Backhaul over White Spaces," ACM MobiSys, 2020. (possible alternative to paper 1)