Application Sharing In Ad Hoc Network (ASIAN)

Naveen Kumar,Ravi Kumar,Manoj Kumar Gangwar,Vivek Kumar

Abstract-Establishing peer-to-peer (P2P) file sharing for mobile ad hoc networks (MANET) requires the construction of a search algorithm for transmitting queries and search results as well as the development of a transfer protocol for downloading files matching a query. In this paper, we present a special-purpose system for searching and file transfer tailored to both the characteristics of MANET and the requirements of peer-to-peer file sharing. Our approach is based on an application layer overlay network. As innovative feature, overlay routes are set up on demand by the search algorithm, closely matching network topology and transparently aggregating redundant transfer paths on a per-file basis. The transfer protocol guarantees low transmission overhead and a high fraction of successful downloads by utilizing overlay routes. In a detailed ns-2 simulation study, we show that both the search algorithm and the transfer protocol outperform off-the-shelf approaches based on a P2P file sharing system for the wireline Internet, TCP and a MANET routing protocol.

Advances in portable computing and wireless technologies are opening up exciting possibilities for the future of wireless mobile networking. A mobile ad hoc network consists of mobile platforms which are free to move arbitrarily. Since the nodes are mobile, internode connectivity may change frequently. There is an increasing demand for applications like multiplayer online gaming, where players residing at different locations participate in the same gaming session through their handheld portable devices. Such applications are characterized by a close degree of collaboration, typical of ad hoc network scenarios.

Index Term-MANET, TCP, P2P, IEEE 802.11

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1. Introduction

(IEEE 802.11) networks has made ad-hoc file-sharing networks particularly attractive. Such networks may range in size from very small (a few laptops with 802.11 hooked up together into a network) to very large (a large wired network or computational grid, further augmented by 802.11 equipped mobile participants).

A study of the performance of such networks is complicated by the wide variations and dynamic changes in network size, topology, peer capabilities, communication bandwidths, characteristics of the file shared, etc. Yet a performance study is essential to study better means for information location and transfer, and for minimizing unnecessary work. Our goal in this paper is to come up with a viable approach to evaluating various performance charactistics of adhoc P2P networks. This includes not only the overall methodology, but also the development of the necessary tools for this purpose.

In this paper, we facilitate performance studies of adhoc P2P networks by introducing a random-graph model that attemts to capture some basic properties of these networks, thereby providing a concrete way of emulating and analyzing them. We then analyze various performance characteristics of the network through analytic and simulation approaches. Due to the inherent complexity of the problem, the analytic model is limited to studying basic properties such as reachability and nodal utilizations. To address detailed performance characteristics such as queuing delays and message expiry or loss, we present a simulation framework called ASIAN consists of two parts: (a) Construction of a set of P2P network instances, and (b) Parallel simulation of file search & retrieval over these instances. The first part is based on the random graph model discussed above. The second part allows one to study several aspects of P2P network, both topological and performance related. In particular, it allows the study of reachability properties, total traffic processed by various nodes, queuing behavior of nodes, performance impact of local caching of files, impact of user behavior including timeouts, etc.

An important point to note here is that the secondpart of the tool could well be given networks (or graphs) that don't necessarily come from the first part and thus can be applied in a larger context.

2. How the network with the funny name can make your life easier

When someone says "ad hoc network" do you say gesundheit? I was always reaching for a tissue before I learned what an ad hoc network can do.

The truth is, the network with the funny name is actually a pretty cool invention. In a wireless ad hoc network (also called a computer-to-computer network) computers and devices connect directly to each other, rather than to a server, hub, or router. Why does this matter? Because it means you can quickly set up a temporary network anywhere. And because using an ad hoc network can save you time and can even help you handle stress.

Here are a few ways you might use an ad hoc network:

1. Quickly connect several computers so that you can share files and printers. Need to share the latest sales figures with a co-worker when you're both away from the office? Using an ad hoc network is one great way to do it. Since an ad hoc network is temporary, unless you choose to save it, you don't have to worry about being connected to your co-worker's computer forever.

2. Share an Internet connection with a group of people. Let's say you and a few colleagues are in a conference room and your computer has an Internet connection but the others don't. You can set up an ad hoc network to share that connection with your colleagues, saving the hassle of setting up separate Internet connections for each person.

3. Play multiplayer computer games. Remember what I said about handling stress? A Counterstrike session now and then can do wonders for your mood—not to mention your score.

3. The nitty-gritty details

A while back, we had a rare snowstorm here in Seattle. I wanted to share pictures of my cat romping in the snow. I selected the pictures and copied them to my Public folder. Because I have an ad hoc network set up, my friends can connect to my ad hoc network and my Public folder to see these pictures. (Okay, I admit it—I am one of those wacky cat people.)

Here's what I did, and what you can do too. It only takes a few minutes. Remember those network games you want to play?

1. Click the Start button and then type Network and Sharing Center in the Search box.
2. In the left pane, click Set up a connection or network.

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Network and Sharing Center

Click here to set up an ad hoc network

3. Click Set up a wireless ad hoc (computer-to-computer) network, and then click Next.

    Choose "Set up a wireless ad hoc (computer-to-computer) network"

Click here to set up an ad hoc network

4. On the Give your network a name and choose security options page:

I. Network name. Make up something short, sweet, and memorable (for example, "MyTempNet").

II. Security type. For your computer's security, choose WPA2 Personal. (We don't recommend using WEP.

WPA2 is more secure. If you try WPA2 and it doesn't work, we recommend that you upgrade your network adapter to one that works with WPA2.)

III.   Security key/Passphrase. Ignore the fancy names; security keys and passphrases are basically just passwords.

Now here are some crazy rules (you knew there had to be some, right?):

▪ The passphrase should be 8 to 63 characters long. For example: jAmn5xlw!

▪ Make up something that contains numbers, uppercase and lowercase letters, and symbols. For the best security, the security key or passphrase should not contain words that are in the dictionary. Make sure you either select the Display characters check box or remember the password, because you have to give it to the other people you want to join your network. (Right. Like I'm gonna remember a 63-character password.)

IV.   You can select the Save this network check box so that you can use the network over and over. Otherwise, ad hoc networks just disappear into the ether when you're done using them.

Give your network an easy-to-remember name
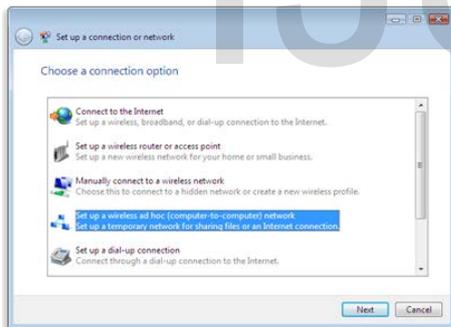
V.   When you're all done, click Next. The network name and security key or passphrase are listed on the next page. Pay attention to these because people will need them to connect to your network. If you want to share your Internet connection, click Turn on Internet connection sharing.

Remember your wireless network name and security key
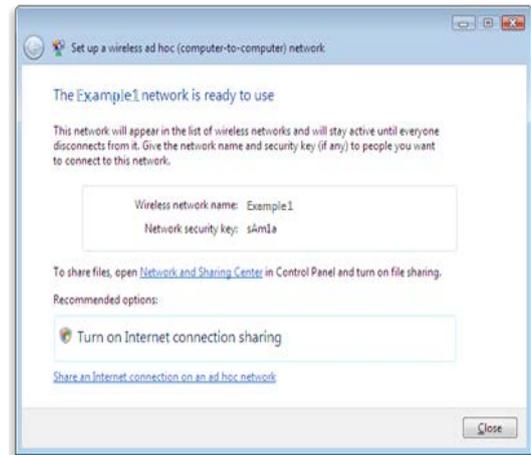
4. A few last steps…

If you want to share files with others on your ad hoc network, first open Network and Sharing Center. Under Sharing and Discovery, make sure file sharing and network discovery are on. If not, click the arrow beside each one to expand that section, click the option to turn it on, and then click Apply. If you want to share files by using the Public folder on your computer, turn on public folder sharing as well. And, if you want to require other people to have a user account on your computer in order to share files with you, turn on password protected sharing (this option is only available for workgroups, not for domains).

Turn on the sharing options you want to use
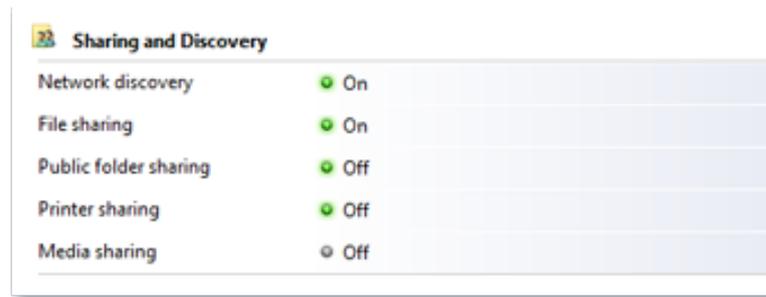
5. Don't be selfish—share your printer!

You can also share your printer with others on an ad hoc network. Here's how:

1.   Click the Start button , click Control Panel, and then, under Hardware and Sound, click Printer.

2. Right-click the printer you want to share, click Sharing, click the Share this printer check box, and then click OK. (If the Share this printer check box is unavailable, click Change sharing options first.)

Share your printer with others
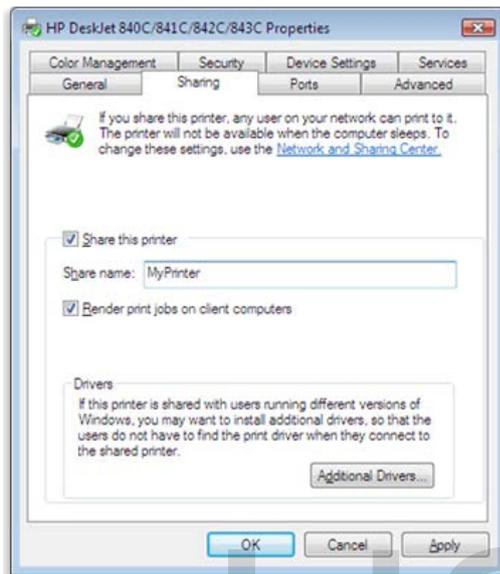
6. Tell your friends

If you saved your ad hoc network and you want your friends to connect to it (to play those games!), here's how they can do it:

1. Click the Start button , click Connect To, click the network you want to join, and then click Connect.
2. On the Successfully connected to <network name> page, if you want to connect to this network again later, click the Save this network check box, and then click Close. (Ad hoc networks normally disappear after you disconnect from them.)
3. On the Select a location for the <network name> network page, click Home or Work. This will automatically turn on network discovery and file sharing.
4. On the Successfully set network settings page, click View computers and devices on the network.
5. To find a file that is shared on another computer, double-click that computer's name in the list, double-

click the Public folder, and then double-click Public documents. Depending on the file permissions, you can read, edit, copy, or print the file.

6. When you're done using the ad hoc network, just disconnect and it will disappear (unless you selected the Save this network check box previously).

7. Get ready for Counterstrike

Now you try it! Go ahead, work off some stress by playing a few network games. If you're at work, don't worry. Just tell your boss you're improving your computer skills.

8. Time for lunch?

What did I tell you? Your ad hoc network has made you twice as productive while reducing your stress. Now go have that tofu burger with sprouts that you've been thinking about. To your health!

9. CONCLUSION

This paper presented analytic and simulation based approaches to studying the performance of generic peer-to-peer (P2P) file-sharing networks. The underlying P2P network is modeled via a random graph which certain characteristics similar to existing Gnutella networks, although the simulator can use networks generated using other mechanisms as well. A key contribution of the paper is a discussion of some ways for simulating the random-graph model without too much computational expense. The paper also discusses some sample performance results by varying several characteristics of the network and the content location mechanism. The main value of the example is not so much in results per se but in the discussion surrounding the choice of various parameter values. It can be extended to study a variety of other issues of interest for P2P sharing networks. These include (a) intelligent, automatic propagation of files through the network based on recent access history, (b) explicit modeling of user retry behavior in case of user timeouts, (c) explicit modeling of dynamic changes to the network, and (d) a more explicit representation of the underlying physical network and the mapping between this and the virtual P2P network. In a large network, many responses may be duplicates or otherwise redundant. A mechanism for early duplicate (or redundancy) detection could make the searches considerably more efficient. For example, schemes that batch responses to

weed out duplicates at intermediate nodes might be of interest. Another interesting idea is to meld together the blind-search approach of Gnutella and the distributed hash-table (DHT) based ordered search approach in order to come up with a scheme that can represent a broader spectrum of content lookup.

Finally, intended to be released in an open-source form so that other researchers can enhance

it and do further interesting studies with it.

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