VAASAN AMMATTIKORKEAKOULU
VASA YRKESHÖGSKOLA
UNIVERSITY OF APPLIED SCIENCES

Baiqi Wu

Route Tracing Map Application

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CONTENTS

ABBREVIATIONS

ICMP Internet Control Message Protocol

TTL Time To Live

IP Internet Protocol

1 INTRODUCTION

This is a report to describe a computer network project named TraceRouteApp, which help user more profound understanding of route transmit action from host pc to the destination server.

Route Tracing map application is a diagnostic tool for displaying the route (path) and measuring transit delays of packets across an Internet Protocol (IP) network. It support ICMP mode to trace the route path between host PC to destination server and drawing the map view for the route paths and enable user to choose a device network interface to capture the interface network activity.

The application is a cross platform application, which has been tested on linux and windows platform. The usage instruction will describe in following sections. The purpose of this application is to make route transition more intuitionistic.

The project application is developed by java language with third party library named JpCap, which is a java library for capturing and sending network packets.

2 TECHNOLOGY REVIEW

This part is a technical scope which used for this application. The programming language is Java, the platform is windows OS or linux OS, the third library named JpCap. There will be detailed introduction and definition for each part and the main features of those technologies will be described in detail below.

2.1 Traceroute

In computing, traceroute is a computer network diagnostic tool for displaying the route (path) and measuring transit delays of packets across an Internet Protocol (IP) network.

Traceroute sends a sequence of Internet Control Message Protocol (ICMP) echo request packets addressed to a destination host. Determining the intermediate routers traversed involves adjusting the time-to-live (TTL), aka hop limit, and Internet Protocol parameter. Routers decrement this and discard a packet when the TTL value has reached zero, returning the ICMP error message ICMP Time Exceeded. The most commonly used value of TTL, when not using traceroute, is 128 (Windows) or 64 (Linux).

2.2 JpCap Library

Jpcap is a Java library for capturing and sending network packets. It provides facilities to:

1. capture raw packets live from the wire.
2. save captured packets to an offline file, and read captured packets from an offline file.
3. automatically identify packet types and generate corresponding Java objects (for Ethernet, IPv4, IPv6, ARP/RARP, TCP, UDP, and ICMPv4 packets).
4. filter the packets according to user-specified rules before dispatching them to the application.
5. send raw packets to the network

Jpcap is based on libpcap/winpcap, and is implemented in C and Java.

Jpcap has been tested on Microsoft Windows (98/2000/XP/Vista), Linux (Fedora, Ubuntu), Mac OS X (Darwin), FreeBSD, and Solaris.

3 APPLICATOIN USAGE

The route tracing application has a very simple user interface as following:

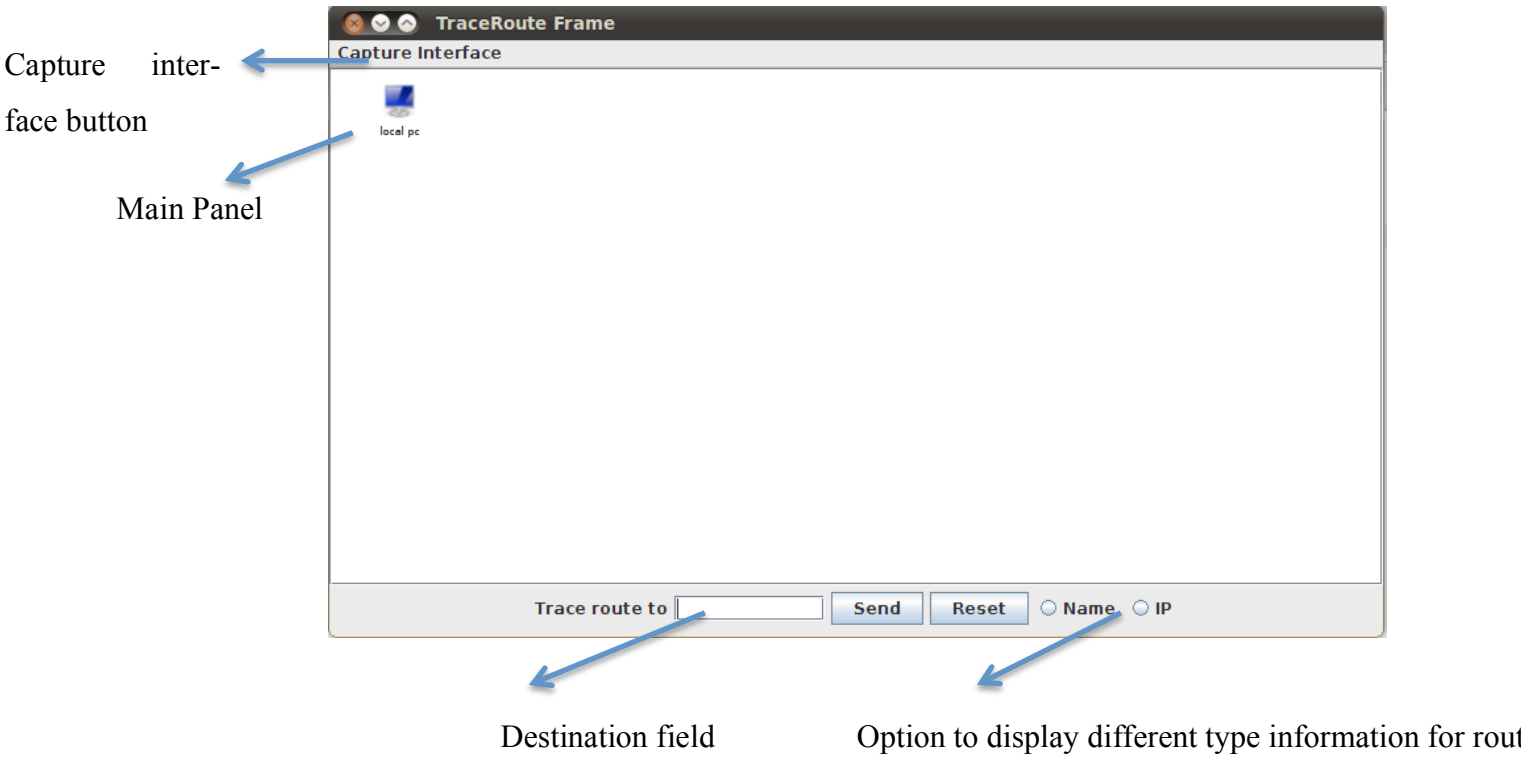

Figure 1. Main App UI

The first user have to click the menu button “Capture Interface”, there will be a device interface list dialog will pop up like:

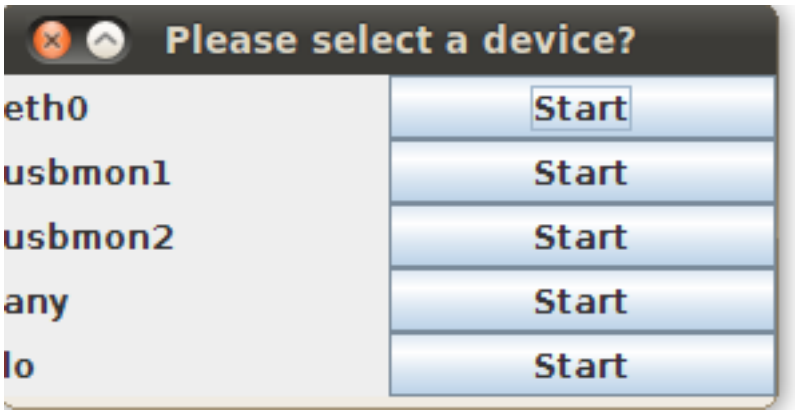

Figure 2. Device interface list dialog

User have to choose an available device interface for the application, because there will be only one interface is mainly represent the operating system network activity. In this case I choose eth0 as my device interface to tracking the network activity and click start button.

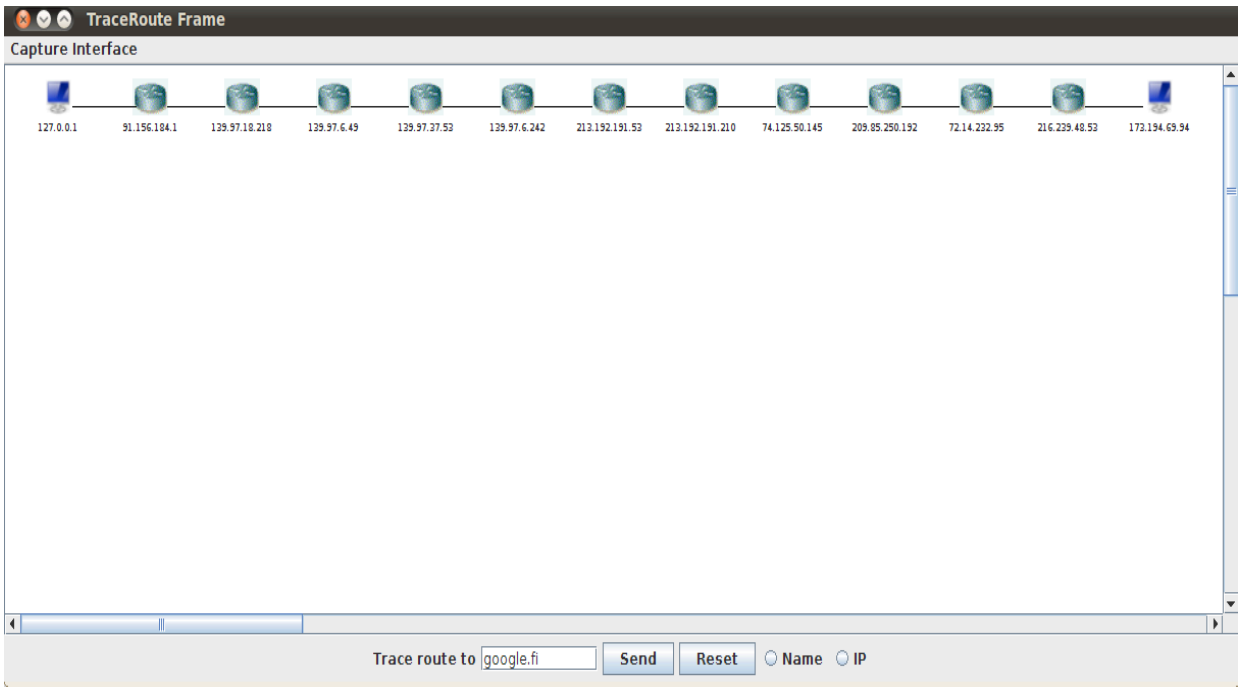

Figure 3. Trace route result

Then user can input destination domain name or ip address to the destination field and click send button, the route tracing map will be showing as Figure3.

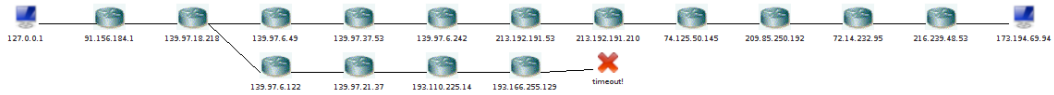

Figure 4. Time out view

If a router or host discards a packet due to a time-out, it will generate a TimeExceeded Type 11 ICMP, and return to the application, the application will show like Figure 4.

4 APPLICATION LOGICAL

The idea of route tracing map application is based on using Internet control message protocol (ICMP) to get router information from each node. Firstly, the applications create an ICMP package with initial parameters as snippet 1.

```
ICMPPacket icmp=new ICMPPacket();
 icmp.type=ICMPPacket.ICMP_ECHO;
 cmp.seq=1;
 icmp.id=0;
 // create traceroute trace to google.fi
 icmp.setIPv4Parameter(0,false,false,false,0,false,false,false,0,0,0,IPPacket.IPPROTO_ICMP,
 thisIP,InetAddress.getByName(dstName));
 icmp.data="data".getBytes();
 EthernetPacket ether=new EthernetPacket();
 ether.frametype=EthernetPacket.ETHERTYPE_IP;
 ether.src_mac=device.mac_address;
 ether.dst_mac=gwmac;
 icmp.datalink=ether;
 captor.setFilter("icmp and dst host "+thisIP.getHostAddress(),true);
 JpcapSender sender=captor.getJpcapSenderInstance();
 sender.sendPacket(icmp);
```

Snippet 1. Create a new ICMP packet

Then routers will use the returned ICMP messages to produce a list of routers and draw them on the application main panel. Because trace route works by increasing TTL value of each successive set of packets sent, the application will continues increasing hop limit until the application received destination router reply. There will be four types of reply message will be received by application. They are timeout, time exceed, time unreach and echo reply.

Time out means if a packet is not acknowledged within the expected timeout.

Time exceeded is generated by a gateway to inform the source of a discared datagram due to the ttl field reaching 0.

Time unreach means if destination unreachable, the time unreach messages will be generated in response.

Echo Reply means the icmp is successful reached to the destination and reply this type of message to notify application the destination has been reached.

The snippet 2 is the logical of message handler in the application.

```
while(!isDestination&&icmp.hop_limit<30){
 boolean isRouteExist=false;
 ICMPPacket p=(ICMPPacket) captor.getPacket();
 if(p==null){
    if(timeOutTimeAtFirstTime){
    System.out.println("Timeout");
    TimeOutTimeAtFirstTime=false;
   }else{
    addNewNodeOnRouteMap(icmp, p, "/img/sair.png");
    icmp.hop_limit++;
   }
   }else if(p.type==ICMPPacket.ICMP_TIMXCEED){
    //from 0 start get first ip && hop_limit 0 -1  255
    if(icmp.hop_limit==0){
      firstHop=p.src_ip.getHostAddress();
      addNewNodeOnRouteMap(icmp, p, "/img/router.gif");
      icmp.hop_limit++;
    }
      //get last first ip hop number
      if(p.src_ip.getHostAddress().equals(firstHop)){
      firstHopPos++;
      icmp.hop_limit++;
      }else{
      System.out.println("hoplimit" + icmp.hop_limit);
      addNewNodeOnRouteMap(icmp, p, "/img/router.gif");
      icmp.hop_limit++;
      }
      }else if(p.type==ICMPPacket.ICMP_UNREACH){
      p.src_ip.getHostName();
      System.exit(0);
      }else if(p.type==ICMPPacket.ICMP_ECHOREPLY){
      addNewNodeOnRouteMap(icmp, p, "/img/no.png");
      isDestination=true;
      }else continue;
      icmp.seq++;
      sender.sendPacket(icmp);
}
```

Snippet 2. Message Handler

5 APPLICATION INSTALLATION

Windows:

1. Install Winpcap (http://www.winpcap.org/install/default.htm)
2. Install Jpcap on windows (http://code.google.com/p/ipamss/downloads/detail?name=JpcapSetup-0.7.exe&can=2&q=)
2. Run command in administrator.
3. java -jar *.jar
4. Click capture interface on the menu bar, and select the device interface which you are using,
5. Insert the trace url in the textfield and click send button.

Linux:

1. Install JpCap Rpm package (http://www.eden.rutgers.edu/~muscarim/jpcap/download.html)
2. Run command in administrator
3. sudo java -jar *.jar
4. Click capture interface on the menu bar, and select the device interface which you are using,
5. Insert the trace url in the textfield and click send button.

6 CONCLUSION

Route tracing application is a tool developed by java program language with third party library called JpCap. The application has been achieved main features of traceroute action under PC and made graphic interface instead of text-line show under the command window.

In this application, you can diagnose the network status, tracing and displaying route path, set new destination IP, and show each node details information on the-route map.

In the future, it will have more features with this application like add Dijkstra algorithm to improve the topological graphic of route.

7 REFERENCE

[1] JpCap website. (2007). [WWW]. Available on the internet: <URL: http://www.eden.rutgers.edu/~muscarim/jpcap/index.html>

[2] The Story of the PING Program.

[3] http://en.wikipedia.org/wiki/Traceroute