CIS 527 Computer Networks

Programming Assignment #3

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Abstract

Our work focuses on the use of traceroute and ping to assess the accuracy of our hypotheses concerning the behavior of the packet as it travels to our target sites, and the likelihood we experience packet loss. Our first hypothesis, is that for sites in different countries, we would experience more frequent changes in the path to said sites when testing with traceroute. Our second hypothesis, is that for sites in different countries, we would experience more frequent packet loss and higher RTT on average.

Methodology

We looked at a mixed set of sites. Four sites are located in the U.S., [www.ford.com](http://www.ford.com), [www.google.com](http://www.google.com), [www.amazon.com](http://www.amazon.com), and www.oracle.com. Six sites are located in different countries around the world. [www.imma.ie](http://www.imma.ie) is located in Ireland. [www.nemox.net](http://www.nemox.net) is located in Austria. [www.registro.br](http://www.registro.br) is located in Brazil. [www.network-tools.com](http://www.network-tools.com) is located in Canada, and [www.playstation.jp](http://www.playstation.jp) is located in Japan. We ran traceroute and ping 10 times for each site, aggregating the results for our analysis.

Traceroute Conclusions

Traceroute Learnings

Ping Conclusions

1. Looking first at loss rate, the results do not suggest sites located on other countries necessarily experience more frequent loss rates. For 8 of the sites, the loss rate was NO LOSS. This included the four sites in the U.S., [www.google.com](http://www.google.com), [www.ford.com](http://www.ford.com), [www.amazon.com](http://www.amazon.com), and [www.oracle.com](http://www.oracle.com), and four sites outside of the U.S., [www.imma.ie](http://www.imma.ie), [www.nemox.net](http://www.nemox.net), [www.network-tools.com](http://www.network-tools.com), and [www.playstation.jp](http://www.playstation.jp). One site experienced major losses i.e. [www.ford.com.cn](http://www.ford.com.cn), of 100%, and for this reason, should be excluded as a statistical outlier. In the future, another China site and additional readings should be taken to better inform the analysis. One site experienced significant losses, i.e. [www.registro.br](http://www.registro.br) located in Brazil. This could be due to a number of factors, not excluding geographic location, internet infrastructure, or simply the popularity of the site.
2. Looking next at RTT, the results also do not suggest sites located in other countries necessarily experience more frequent loss rates. The top three sites with the lowest avg RTT, were in order, [www.playstation.jp](http://www.playstation.jp) at 1.5 ms, [www.network-tools.com](http://www.network-tools.com) at 1.7ms, and [www.ford.com](http://www.ford.com) at 8.9 ms. In fact, the four U.S. sites, had on average, 4 times higher RTT than the sites located in Japan and Canada. Interestingly, the [www.network-tools.com](http://www.network-tools.com) site located in Canada had the fastest time for any North American site, even over extremely popular CDN supported sites such as google and amazon. There is also a large gap between the fastest avg RTT for a site and those with the slowest avg RTT. [www.registro.br](http://www.registro.br), located in Brazil, and [www.nemox.net](http://www.nemox.net), located in Austria, had almost 100 times worse avg RTT, at 137 ms and 131 ms respectively. Location alone does not explain this variance in RTT. Japan is located approximately 6,413 mi away, while Brazil and Austria are both located approximately 4,400 miles away.

Ping Learnings

When looking to conduct similar work in the future, we felt a few lessons are helpful.

1. First, the sites should be diverse, including differences in popularity, location, and even subject matter, but similar along target characteristics. Critical questions arose e.g. should amazon.com, a popular U.S. site supported by multiple CDNs, be compared to something like [www.imma.ie](http://www.imma.ie), an Irish museum site servicing a much smaller demographic. A better analysis might focus on comparing similar content with varying locations e.g. focusing on only famous museum sites around the world
2. Second, consideration should be given to rules and regulations relevant to the internet in each country. China is notorious for blocking popular U.S. sites i.e. [www.google.com](http://www.google.com) and [www.youtube.com/](http://www.youtube.com/). An interesting topic to research is if that extends to efforts to block internet traffic from the U.S. as well, adding difficult to analyzing said sites.

Appendix A -Traceroute Results

Appendix B - Ping Results

1. Target Classification Loss Rate
   1. www.ford.com
      1. LOSS FREE
   2. [www.google.com](http://www.google.com)
      1. LOSS FREE
   3. [www.amazon.com](http://www.amazon.com)
      1. LOSS FREE
   4. [www.ford.com.cn](http://www.ford.com.cn)
      1. MAJOR LOSSES
   5. www.imma.ie
      1. LOSS FREE
   6. www.nemox.net
      1. LOSS FREE
   7. www.registro.br
      1. SIGNIFICANT LOSSES
   8. [www.network-tools.com](http://www.network-tools.com)
      1. LOSS FREE
   9. [www.oracle.com](http://www.oracle.com)
      1. LOSS FREE
   10. [www.playstation.jp](http://www.playstation.jp)
       1. LOSS FREE
2. Loss Plots
   1. www.ford.com
      1. Text

         Description automatically generated
   2. [www.google.com](http://www.google.com)
      1. Text

         Description automatically generated
   3. [www.amazon.com](http://www.amazon.com)
      1. Text

         Description automatically generated
   4. [www.ford.com.cn](http://www.ford.com.cn)
      1. Graphical user interface, text, application, email

         Description automatically generated
   5. www.imma.ie
      1. Text

         Description automatically generated
   6. www.nemox.net
      1. Text

         Description automatically generated
   7. [www.registro.br](http://www.registro.br)
      1. Chart, line chart

         Description automatically generated
   8. [www.network-tools.com](http://www.network-tools.com)
      1. Text

         Description automatically generated
   9. [www.oracle.com](http://www.oracle.com)
      1. Text

         Description automatically generated
   10. [www.playstation.jp](http://www.playstation.jp)
       1. Text

          Description automatically generated
3. Minimum, Maximum, and Mean RTT
   1. [www.ford.com](http://www.ford.com)
      1. Minimum = 8.783
      2. Mean = 8.9279
      3. Maximum = 10.164
   2. [www.google.com](http://www.google.com)
      1. Minimum = 10.193
      2. Mean = 10.9802
      3. Maximum = 12.338
   3. [www.amazon.com](http://www.amazon.com)
      1. Minimum 9.201
      2. Mean = 9.4123
      3. Maximum = 12.182
   4. [www.ford.com.cn](http://www.ford.com.cn)
      1. Minimum = 0
      2. Mean = 0
      3. Maximum = 0
   5. www.imma.ie
      1. Minimum = 11.559
      2. Mean = 12.1529
      3. Maximum = 19.863
   6. www.nemox.net
      1. Minimum = 129.989
      2. Mean = 131.1379
      3. Maximum = 137.903
   7. www.registro.br
      1. Minimum = 136.799
      2. Mean = 137.06
      3. Maximum = 138.224
   8. [www.network-tools.com](http://www.network-tools.com)
      1. Minimum = 1.528
      2. Mean = 1.7058
      3. Maximum = 13.233
   9. [www.oracle.com](http://www.oracle.com)
      1. Minimum = 7.971
      2. Mean = 8.672
      3. Maximum = 14.174
   10. [www.playstation.jp](http://www.playstation.jp)
       1. Minimum = 1.41
       2. Mean = 1.5174
       3. Maximum = 4.688
4. RTT Plots
   1. [www.ford.com](http://www.ford.com)
      1. Chart, line chart

         Description automatically generated
   2. [www.google.com](http://www.google.com)
      1. Line chart

         Description automatically generated with medium confidence
   3. [www.amazon.com](http://www.amazon.com)
      1. A picture containing line chart

         Description automatically generated
   4. [www.ford.com.cn](http://www.ford.com.cn)
      1. Graphical user interface, text

         Description automatically generated
   5. [www.imma.ie](http://www.imma.ie)
      1. Chart, line chart

         Description automatically generated
   6. [www.nemox.net](http://www.nemox.net)
      1. Chart, line chart

         Description automatically generated
   7. [www.registro.br](http://www.registro.br)
      1. Chart, line chart

         Description automatically generated
   8. [www.network-tools.com](http://www.network-tools.com)
      1. Chart, line chart

         Description automatically generated
   9. [www.oracle.com](http://www.oracle.com)
      1. Chart, line chart

         Description automatically generated
   10. [www.playstation.jp](http://www.playstation.jp)
       1. Chart

          Description automatically generated with medium confidence