Team: SongScribe
Members: Tom Burrow, Ben Chrobot
David Couto, and DC Danko
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Testing and Analysis of Mobile Network Connections

We analyzed the network performance over 3G and WiFi connections. The device we were using did not have 4G or Edge capabilities so these were the only networks available to us. We performed these tests in the Student Center, a dorm (East Campus), and outside in front of Kresge Auditorium. These locations are marked as 1, 2, and 3, respectively, on figures throughout this report.

We found that 3G performed the best in an outdoor environment. It had the lowest average latency as well as the lowest standard deviation between the minimum, average, and maximum latencies. It also had the highest data transfer rate for each of minimum, average, and maximum data points. This makes sense as there is the least obstruction between the phone and the cellular tower providing the service.

Surprisingly the wireless network had the lowest latency outside as well by a significant amount. I would have expected either the Student Center of East Campus to have lower latency because of closer proximity to a router. It's possible that the router the device connected to outside of Kresge was under less of a traffic load and thus had fewer packet collisions. This would make sense given the number of users in the Student Center versus where the device was being tested. Further testing would have been useful for this particular question.

East Campus had the overall worst performance both networks. The latency for 3G was the second worst for the three locations. 3G bandwidth also performed poorly. WiFi was not much better with the worst of both latency and bandwidth. The tests were performed on the fifth (top) floor of East Campus in a room with a window. We expected that conditions in the first floor of the Student Center would have been much worse given amount of overhead obstruction for 3G and number of users for WiFi.

The explanation we arrived at was that it was either the building materials in East Campus or functionality of a cell tower repeater. East Campus is a much older building than the Student Center and is known to contain materials such as asbestos. It is possible that these old materials provide more of a screen than the cement of the Student Center.

There are plainly visible cell repeaters in the halls of East Campus, although they are not marked with a carrier. It is possible that the Student Center has these as well, although all evidence of daily use suggests otherwise. If the Student Center does not have repeaters then East Campus would seem to have the advantage with its repeaters, unless they are for a different carrier than our test device or they simply do not function. If the Student Center does have repeaters then they must be functioning better than those in East Campus, however badly they still work overall.

The usage statistics we encountered while doing this assignment boded well for our application. Our primary product deals with MIDI files, which are very small binary files. These do not require a large amount of bandwidth to be uploaded to the main server. They also do not need be transmitted for full functionality. In fact, it is actually unlikely that a user will require an instant upload, as the purpose of SongScribe is to provide a way for amateur musicians to store ideas while they are on the go and not at workstation where access to the MIDI file from our site would be

useful. It is trivial to run a background service that will lazily upload the MIDI files when a connection is available.

It follows from this that latency is also not a determining factor for our application. The transfer of the MIDI files does not explicitly require a low latency. Social interaction operations such as sharing a project with a friend, however, will require fast responses. Even the maximum latency values we saw were low enough that it would not be inconvenient for a user (see figures 1 and 2 below).

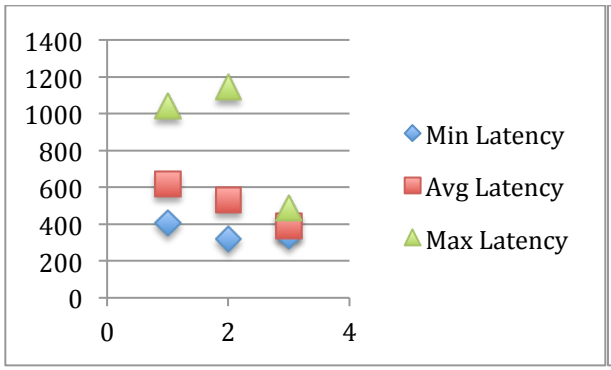

Figure 1 Ping statistics for 3G
(time in milliseconds)

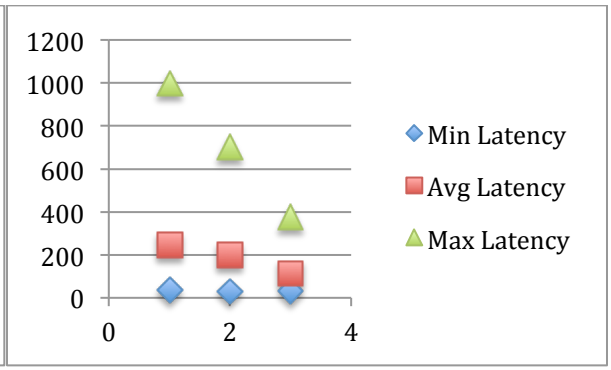

Figure 2 Ping statistics for WiFi
(time in milliseconds)

The only times when higher bandwidth would be required would when uploading Inspiration Tags. These multimedia tags can take a variety of forms and serve as connection back to the mental state the user was in when they came up with the song idea. This allows them to more easily get back in touch with the piece they are working on when they come back to it. These tags may also be lazily-uploaded though as they are not required immediately after they are created. The bandwidth rates we saw with WiFi were certainly enough to upload a standard audio clip or image. The 3G rates, while noticeably slower (see comparison in figures 3 and 4 below), are also enough and serve up multimedia for every other application so users will be used to the mobile-application standard speed.

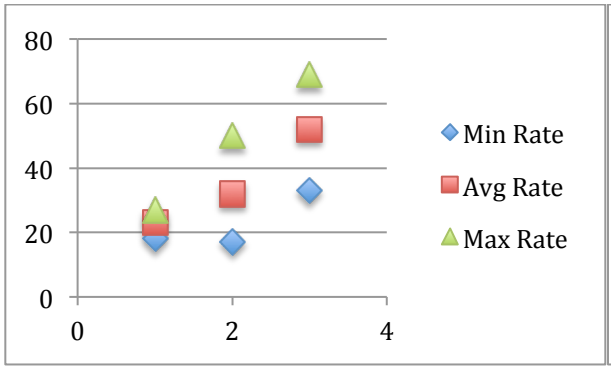

Figure 3 Rate statistics for 3G
(rate in kB/s)

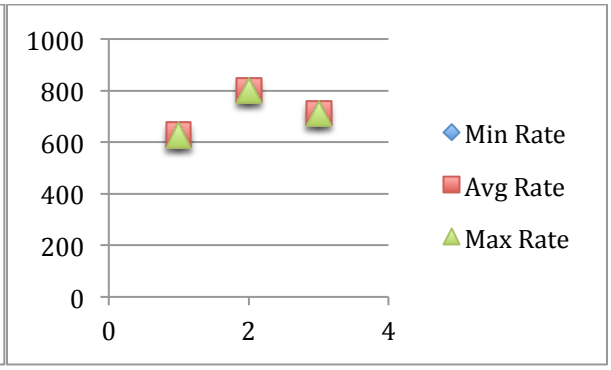

Figure 4 Rate statistics for WiFi
(rate in kB/s)

Student Center

3g

Latency values (ms): 1043, 530, 407, 578, 536
5s period 0, rate: 26 kB/s
5s period 1, rate: 27 kB/s
5s period 2, rate: 18 kB/s
5s period 3, rate: 23 kB/s
5s period 4, rate: 24 kB/s
Total rate: 23 kB/s in time 27s

WiFi

Latency values (ms): 998, 90, 41, 35, 50
Average rate: 628 kB/s in time 1s

East Campus

3g

Latency values (ms): 1145, 412, 318, 400, 379
5s period 0, rate: 34 kB/s
5s period 1, rate: 17 kB/s
5s period 2, rate: 24 kB/s
Total rate: 32 kB/s in time 20s

WiFi

Latency values (ms): 704, 33, 152, 30, 79
Average rate: 802 kB/s in time 1s

Kresge

3g

Latency values (ms): 490, 424, 338, 348, 345
5s period 0, rate: 69 kB/s
5s period 1, rate: 33 kB/s
Total rate: 52 kB/s in time 12s

WiFi

Latency values (ms): 35, 56, 376, 73, 32
Average rate: 712 kB/s in time 1s