

Gustavus Phone Line Assessment Using Analog Modems

February, 2008

By Corvid Computing
Nathan Borson and Sean Neilson
PO Box 281
Gustavus, AK 99826
<http://corvid.info>
info@corvid.info
(907) 697-2810

For the City of Gustavus
Gustavus Community Network
Bruce Paige, Administrator
PO Box 1
Gustavus, AK 99826
<http://gustavus.ak.us>
help@gustavus.ak.us
(907) 697-2622

Introduction

In November 2006 Alaska Communications Systems (ACS) replaced their central office and a carrier system that serves many Gustavus customers. Subsequently dial-up Internet access was severely impaired for many Gustavus customers. Municipal Internet Service Provider Gustavus Community Network (GCN) commissioned this report to quantify connection quality with various combinations of modems and phone lines in order to determine the extent of the problem.

Executive Summary

We tested 14 phone lines in Gustavus, focusing on areas where connection quality problems have been reported. We found clear differences between locations and between modems used for testing. Regardless of modem used, only two of the lines tested consistently support connect speeds of 28.8 Kbps or better as required by Alaska Administrative Code. Six phone lines are unusable with many modems but all lines were usable with one modem. Modems we used for testing connect faster than many used by GCN customers so their experience is often worse than shown in this report.

We performed no comparable testing prior to the ACS changes in November 2006 and have no records from which to derive quantitative differences in connection speed since that event. We were able to demonstrate sub-standard performance in 12 of 14 lines tested. In many cases, including the six lines we dubbed "Class C," qualitative changes that occurred with the ACS cut-over are well documented.

Locations

After testing all locations we analyzed the results and found that with few exceptions the lines fall into three groups based on the performance of the connections. We dubbed these Classes A, B, and C. With few exceptions the groups corresponded to geographical areas as described in this section.

Speed (RD/TR) versus Location	Class A (Qty: 2)	Class B (Qty: 6)	Class C (Qty: 6)
Minimum speed	16800/28800	7200/21600	4800/21600
Maximum speed	26400/50666	26400/28800	24000/28800
Average speed	21600/43833	22179/25986	18253/26379
Average speed, Courier modem	21600/40333	22600/25000	15032/26274
Average speed, Hawking modem	Not tested	14880/26400 (Qty: 1)	4800/26400 (Qty: 1)
Sub-standard line quality?	No	Yes, somewhat	Yes, unusable by many modems

Source: Appendix B test data

Class A: Central Gustavus and Dolly Varden Lane

Class A connections have connect speeds (TR Rates) of 28.8 to better than 50 Kbps. They meet or exceed the standard of 28.8 Kbps set forth in Alaska Statute. We have had some reports from customers with Class A connections of decreased performance following the ACS changes in November 2006 but have not substantiated them. We investigated one case and found performance problems were due to inside wiring changes that coincided with the ACS cut-over.

We tested only two Class A lines but would expect to find many more in the Old Same Road, Airport, Dock Road, and Dolly Varden Rd. areas. One line in the Dolly Varden area, however, (Gustavus Clinic, 697-2675) tested as Class C.

Phone Number	Occupant	Neighborhood	Notes
697-2369	Gustavus Public Library	Airport	
697-2262	Paige	Dolly Varden	Found performance problems due to inside wiring.

Class B: Bartlett Cove and Rink Creek

Class B connections seldom achieve and never exceed TR Rates of 28.8 Kbps. While we found these lines usable with our two main test modems, some of these customers reported slow performance and frequent disconnects since the November 2006 ACS cut-over and we have observed them connected to the GCN equipment with RD Rates of 4800. We investigated this discrepancy in some depth at 697-2323 and found that a third test modem gave results closer to the customer's experience. We also found the results inside the house were the same as at the NID. We conclude inside wiring was not at fault in this case and that our test modems are of such high quality that they mask line quality problems afflicting many GCN customers. We lack sufficient data to say conclusively that these lines suffered a decrease in connection quality as a result of the ACS cut-over in November 2006 but given the rarity of a 28.8 Kbps connection even with the best modems we judge these lines sub-standard.

Phone Number	Occupant	Neighborhood	Notes
697-2121	Lassiter	Rink Creek	This customer was receiving RD Rate=4800 but we were unable to duplicate these results with our modems so may be customer premises wiring or our test modems are not as sensitive to line conditions as the customer's.
697-2305	Calkin	Mountain View	This customer was unable to connect with her Apple modem immediately following the ACS cut-over and had to purchase a MultiTech. Given the neighborhood and customer history we expected Class C performance and were very surprised to find a Class B line.
697-2323	Martinez	Bartlett Cove	This customer was receiving RD Rate=4800 but we were unable to duplicate these results with our two primary test modems. Additional testing with another, more sensitive modem yielded RD Rate=7200 in 3 of six tests. There was no variation

			between inside wiring and the NID.
697-2776	Lassiter	Rink Creek	See 697-2121
697-2780	Eneix	Rink Creek	Same situation as 697-2121
697-2805	Seraphin	Bartlett Cove	

Class C: Good River and Mountain View

Class C connections are clearly inferior and suffered a definite and dramatic decline following the November, 2006 ACS cut-over. In many cases the connections were suddenly unusable due to difficulty connecting, frequent disconnects, and extremely slow to zero throughput on dial-up connections. These customers either replaced their modems with the Multitech used in our testing or discontinued their dial-up Internet service.

The connect speeds reported by customers' modems (a minimum of 21,600 bps in our tests, usually 26,400 and rarely even 28,800) do not account for the severe performance degradation. These reported connect speeds are the download (from Internet to customer) speeds negotiated by the modems, reported in our test data as "TR Rate" (as shown on the GCN Portmaster). The modem does not report the upload (from customer to Internet) speeds but we can see from the GCN equipment that those speeds, as low as 4,800 bps, are the cause of the problem, and we were able to duplicate those results using a US Robotics Courier V. Everything modem known to work well even on many sub-optimal phone lines. These speeds are reported in our test data as "RD Rate" as they are shown on the GCN Portmaster.

Even though the average speeds of Class C connections look little worse than Class B, every phone line we put in this class had at least one test result with an RD Rate of 4,800 using the Courier modem. Whenever the RD Rate is this low the connection is basically unusable.

Phone Number	Occupant	Neighborhood	Notes
697-2140	Neilson	Mt. View Rd	
697-2287	Streveler	Mt. View Rd	
697-2313	Borson	Good River Rd	"Before the ACS cutover I was able to consistently connect at 28.8 Kbps. Now the best I ever get is 26.4 Kbps and some modems do not work at all at my house."
697-2765	Clinic	Dolly Varden	Clinic purchased MultiTech modem because their other modems were getting RD=4800. One of three tests on the Courier modem had an RD=4800 connection so rated this line "Class C." It is almost "Class B" however since two other tests with the Courier modem had good RD rates.
697-2840	Neilson	Mt. View Rd	Did extensive testing on this line. Only one of eight tests with the Courier modem resulted in an RD Rate of 4800 so this is almost a Class B line, similar to 697-2305.
697-3040	Heacox	Good River Rd	Purchased a Multitech modem as theirs consistently negotiated RD speed of 4,800 after November 2006.

Test Modems

- MultiTech external USB modem: MT5634ZBA-USB-GLOBAL – These tolerate Gustavus phone line conditions better than any other modems we have used. Nathan Borson sold 10 of these in Gustavus since November, 2006 to customers who were able to connect with their existing modems before that time but who had unusable to no connections since the ACS cutover.
- US Robotics external modem: Courier v. Everything. This modem exhibits the problematic RD Rate of 4,800 bps on Class C phone lines. However, it seems to work considerably better than some customers' modems on Class B lines so may mask connection quality problems they are experiencing.
- Hawking technology SmartUSB56 external modem (tested only on two lines). This modem's performance is closer to what many customers are seeing as demonstrated at 697-2323.

Conclusions

1. 12 of 14 lines tested fail to meet the “end-to-end data transfer rate of no less than 28.8 kilobits per second” set forth in [3 AAC 53.705 \(f\)\(1\)\(C\)](#), even using the best available modems. Many customers experience performance worse than reported in this assessment.
2. Some failing lines are worse than others. Differences generally follow geographic boundaries.
3. Based on customer reports, modem sales, and memory of connect speeds observed on the GCN equipment, most if not all of the 12 failing lines did meet the 28.8 Kbps standard prior to November, 2006. However, we have no comparable baseline data with which to make a quantitative comparison.

Appendix A: Methodology

Calls were made from multiple locations in Gustavus using identical equipment and methods using the following procedure. For each call one data record was created in a spreadsheet. An explanation of each column's contents follows.

Hardware and Software Used

- Test modems are listed in the body of the report.
- Livingston [Portmaster](#) PM-3A-2T with 48 56K modems owned by Gustavus Community Network, located at the Gustavus Public Library, and connected to the ACS Central Office with a channelized T1 circuit. Gustavus dial-up users connect to this Portmaster by calling 697-2345 with their analog modems. To test whether the Portmaster was the cause of the dial-up troubles, this unit was temporarily replaced with a standby Portmaster and tested the night of 12/5-6/2007 from two phone lines. In the test from 697-2140 with the Courier modem we obtained the same RD Rate=4800 that we did with the main Portmaster.
- [PMVision](#), a java application for monitoring and configuring the PortMaster.
- [Btest.exe](#), a Windows bandwidth measurement tool from [Mikrotik](#). It measures throughput to the GCN Mikrotik core router located at the Gustavus public library. The Portmaster is plugged directly into the core router so there is no bandwidth bottleneck or latency between the Portmaster and the core router. Thus this accurately measures the actual throughput on the dial-up connection.

Procedural Overview

1. Unplug the house wiring from the ACS NID on the outside of the premises. Plug our long phone cable into the NID.
2. Connect the phone line to the MultiTech modem and the multitech modem to the test laptop computer. Configure the dial-up connection to use the MultiTech modem.
3. Dial in to GCN (697-2345).
4. Record the phone number from which you are dialing and the time when the connection to GCN was made.
5. Close any applications that might communicate over the Internet. Make sure there is no traffic over the connection (i.e. observe that the TD and RD/SD lights on the modem are *off* - not flickering).
6. Run btest.exe using the settings described for columns D-E and record the results.
7. Record any noteworthy abnormalities or special test conditions.

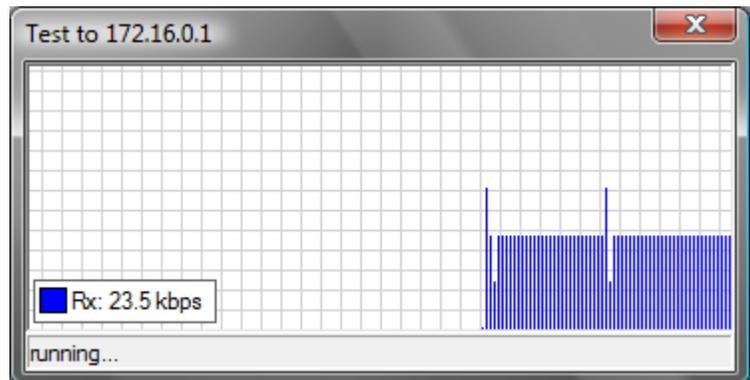


Illustration 1: Good test showing consistent receive speed of 23.5 Kbps with standard size, speed settings



Illustration 2: Inconclusive test; inconsistent transmit speeds with Tx Size set to 1500 and speed 28800

8. Start PMVision and record the connection speeds, renegotiates, and retries. Close PMVision or device-disconnect.
9. Disconnect the dial-up connection and Repeat steps 3-8.
10. Disconnect the dial-up connection and the modem. Connect the US Robotics external modem, configure the dial-up connection to use it, and repeat steps 3-9.
11. Record a statement from the homeowner about whether and how their connection quality changed in November, 2006 (after the ACS outage).

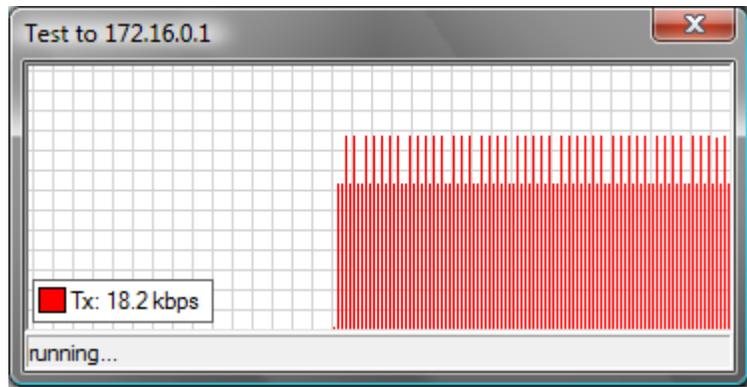


Illustration 3: Consistent results varying between 18.2 and 24.2 Kbps

Columns D-E: Bandwidth Tester

Run Mikrotik bandwidth test client btest.exe with these standard settings:

- Protocol: UDP
- Local & Remote Tx Size: 1500 bytes
- Local & Remote Tx Speed: 28800 bps
- Important: **Random Data.** Otherwise compression masks the underlying connection quality.

Before clicking the start button make

sure the connection is idle by checking the RD and SD/TD lights on the modems. They should be *off*, not flashing, before you click the start button.

Run one send test and one receive test, recording the results in columns D and E of the spreadsheet, respectively. You should get a steady, consistent result like the one shown in illustration 1. If you get no connection or results like those shown in illustration 2, reduce the Tx Size (Local for send test; Remote for receive test) and run the test again until you get consistent results as shown in illustration 4, noting in the comments column the reduced Tx Size or if the connection is too poor to allow a test at all. The best you get may be as shown in illustration 3 where there are two values. In this case you need to interpolate the results. For example in this example there are roughly equal numbers of bars at 18.2 and 24.2 Kbps so the result is halfway between, or 21.2. Such a calculation can be done in the cell on the spreadsheet.

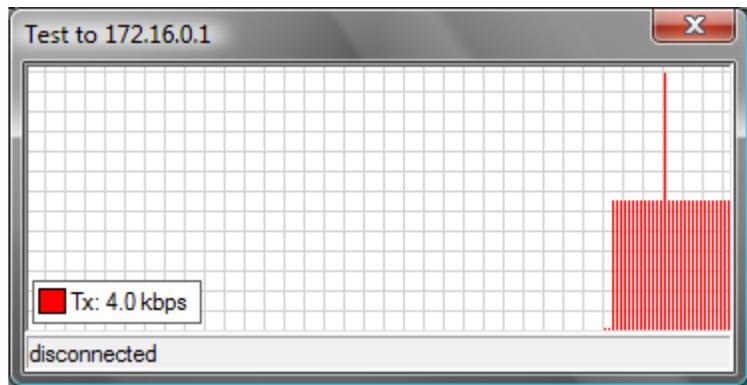


Illustration 4: Good test with Tx Size set to 500 and speed to 28800

Columns F-I: Portmaster

Log in to the GCN portmaster with PMVision, locate your modem under users, then under modem details. Record the following in the spreadsheet: connection speed for both directions (inbound to Portmaster: "RD Rate;" outbound from Portmaster: "TR Rate"), renegotiates, and retrains. In comments, note protocol and compression if other than LAPM/V42BIS.