

# Assymetry Measurements at the User Interface

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## A.1 BACKGROUND

How much idle time is available for backups using a dialup modem? Measurements of dialup modem traffic were taken over a 4-day period for 31 terminal servers on the Rutgers University-New Brunswick campuses. The purpose of taking the measurements is to study the asymmetries in dialup usage at the boundary of the Internet, which serves as a reference point in determining available uplink bandwidth.

The measurements are static in the sense that we simply probed the terminal servers for information that is recorded on-the-fly with periodic updates. We did not instrument the lines or monitor the actual data as it was transmitted.

We found that 9% of the network traffic flows upstream from the end user to the Internet, which means that 91% of the available uplink bandwidth from the end user to the Internet is unused.

### *A.1.1 Introduction*

Several components in a local area network (LAN) or a wide area network (WAN) maintain statistics on traffic through the component interfaces. These statistics are maintained as variables in a management information base (MIB). The MIB can be queried using the simple network management protocol (SNMP). In the measurements reported here, we use SNMP to query the MIB variables of 31 terminal servers at Rutgers University-New Brunswick over the closest link to the user (the so-called “last mile” of the Internet).

The older version 0 of the SNMP protocol (referred to as SNMPv1) is used in this study because the newer version 1 (SNMPv2) is not supported by at least some of the components in the reference network.

We know from other studies that there is an asymmetry in traffic flows over a dialup modem connection. In general, a greater flow of traffic moves downstream to the end user than on the upstream to the network. Intuitively this makes sense, as it only takes a few keystrokes to cause an entire page to be downloaded, but the degree of asymmetry is complicated by protocols, compression, and other factors.

### *A.1.2 System Configuration*

The traffic samples were taken over 31 terminal servers connected to the Rutgers University RU-Net campus backbone. There are more terminal servers than are listed below, but this subset was chosen because the terminals respond to public SNMP queries. The system configuration over which the measurements were taken thus does not include measurements of all of the dialup traffic into and out of the Rutgers network.

The domain name system (DNS) information for the terminal servers is shown below.

This information can be used by anyone outside of the rutgers.edu domain:

TERMINAL SERVER NAME	IP ADDRESS	
New Brunswick		
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coretop.rutgers.edu	128.6.171.6	
rooftop.rutgers.edu	128.6.171.7	
blacktop.rutgers.edu	128.6.171.8	
tippytop.rutgers.edu	128.6.171.9	
branford.rutgers.edu	128.6.225.6	
quincy.rutgers.edu	128.6.225.7	
dizzy.rutgers.edu	128.6.225.8	
calloway.rutgers.edu	128.6.225.9	
vaughn.rutgers.edu	128.6.225.10	
blakey.rutgers.edu	128.6.225.250	
waller-a.rutgers.edu	128.6.44.54	
waller-b.rutgers.edu	128.6.44.71	
waller-c.rutgers.edu	128.6.44.88	
parker-a.rutgers.edu	128.6.44.3	
parker-b.rutgers.edu	128.6.44.20	
parker-c.rutgers.edu	128.6.44.37	
mingus-a.rutgers.edu	128.6.44.105	
mingus-b.rutgers.edu	128.6.44.122	
metheney.rutgers.edu	128.6.44.139	(Not SNMP queriable.)
monk.rutgers.edu	128.6.225.3	(Not SNMP queriable.)

Newark:

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erbium.rutgers.edu	128.6.53.89
iridium.rutgers.edu	128.6.53.90
niobium.rutgers.edu	128.6.53.91
argon.rutgers.edu	128.6.53.86
boron.rutgers.edu	128.6.53.50
carbon.rutgers.edu	128.6.53.67
krypton.rutgers.edu	128.6.53.87
radon.rutgers.edu	128.6.53.88

Camden:

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barry-a.rutgers.edu	128.6.226.62
barry-b.rutgers.edu	128.6.226.63
whitman-a.rutgers.edu	128.6.226.59
whitman-b.rutgers.edu	128.6.226.60
whitman-c.rutgers.edu	128.6.226.61

Each terminal server supports 16 asynchronous (modem dialup) lines, two hardwired asynchronous lines (local RS232 connections), and one Ethernet line. The 16 dialup lines are multiplexed to and from the Ethernet stream. The configuration is shown below:



In terms of octet (byte) counts, we find that upstream dialup traffic accounts for 9% of the total traffic over the dialup lines, and that upstream dialup traffic accounts for 51% of the packets transmitted over the dialup lines.

The average upstream packet size is 49 bytes, and the average packet size from the terminal server to the network is 77 bytes. The average downstream packet to the user is 337 bytes, and the average packet size from the network to the terminal server is 342 bytes.

#### *A.1.4 Discussion*

Differences in traffic to/from terminal servers versus traffic to/from the dialup lines result from: (1) error packets, (2) buffer overflows, (3) SNMP traffic that terminates or originates in the terminal server, (4) Ethernet broadcast/multicast traffic that terminates in the terminal servers, (5) routing protocol traffic, (6) IEEE 802.3 translation which increases the upstream packet sizes, and (7) CSLIP/PPP header decompression.

#### *A.1.5 Conclusion*

Internet dialup traffic is asymmetric at the network boundary. Only 9% of the uplink bandwidth from the end-user to the Internet is currently utilized, which means that 91% of the uplink bandwidth is available for other uses, such as trickle backups.

#### *A.1.6 References*

Stevens, W. R., "TCP/IP Illustrated Volume 1: The Protocols," Addison-Wesley, Chapter 25, (1994).

"Cisco Management Information Base (MIB) User Quick Reference," available at [http://www.cisco.com/univ-src/3.8/doc/software/11\\_0/mib/mtxt.htm](http://www.cisco.com/univ-src/3.8/doc/software/11_0/mib/mtxt.htm).