Measuring Traffic on the Internet

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OVERVIEW

MEASURING TOOLS

MEASURING LIMITS

MEASUREMENT RESULTS

LESSONS TO BE LEARNED

CONCLUSIONS
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CONCLUSIONS
MEASURING TOOLS

LOCAL SYSTEM

REMOTE (END) SYSTEM

ROUTERS

SNIFFERS
MEASURING TOOLS: LOCAL SYSTEM

NETSTAT
TCPDUMP
ETHEREAL
NTOP

PROMISCUOUS MODE
MEASURING TOOLS: LOCAL SYSTEM - NTOP
# MEASURING TOOLS: LOCAL SYSTEM - NTOP

Welcome to nttop!

## Global IP Protocol Distribution

<table>
<thead>
<tr>
<th>IP Protocol</th>
<th>Data</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP</td>
<td>3.5 MB</td>
<td>7.5 %</td>
</tr>
<tr>
<td>NBios-IP</td>
<td>376.7 KB</td>
<td>2.0 %</td>
</tr>
<tr>
<td>NFS</td>
<td>20.9 MB</td>
<td>44.0 %</td>
</tr>
<tr>
<td>X11</td>
<td>19.6 MB</td>
<td>41.1 %</td>
</tr>
<tr>
<td>SSH</td>
<td>10.1 KB</td>
<td></td>
</tr>
<tr>
<td>Other TCP/UDP based Prot.</td>
<td>2.0 MB</td>
<td>6.4 %</td>
</tr>
</tbody>
</table>

Generated by nttop v.1.3.1 NT [sparc-sun-solaris2.6] Listening on [ia0,ia0:0]
© 1998-2000 by L. Dert
MEASURING TOOLS: REMOTE (END) SYSTEM

- MIBS
- IF-MIB
- SNMP
- MRTG
MEASURING TOOLS: ROUTERS

NETFLOW
  • CISCO

LFAP
  • ENTERASYS (CABLETRON)
MEASURING TOOLS: SNIFFERS

RMON
RMON2

NETRAMET
MEASURING TOOLS: SNIFFERS - NETRAMET

NeTraMet

- flowdata
- rulesets
- PME
- packets (pcap, NetFlow, LFAP)

meter reader(s)

manager

analysis application
EXAMPLE OF A RULESET

if SourcePeerType == IPv4
{
    if DestPeerAddress == ( 130.89/16 )
    {
        count;
    }
}
MEASURING TOOLS - CONCLUSIONS

MANY TOOLS EXIST

SOME ARE COMMERCIAL
MANY ARE OPEN SOURCE
ISN’T THIS GREAT?

MANAGERS CAN FIND ADEQUATE TOOLS TO MONITOR THEIR NETWORKS

STUDENTS CAN FIND GREAT TOOLS TO MONITOR WHAT TEACHERS DO

I CAN MONITOR WHAT YOU ARE DOING

…
OVERVIEW

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MEASURING LIMITS

WHAT ARE THE LIMITS OF THESE MEASUREMENT TOOLS? CAN, FOR EXAMPLE, SNIFFERS HANDLE MEGABITS OF TRAFFIC?

TO DETERMINE THIS, WE HAVE EXPERIMENTED WITH NETRAMET ON OUR CAMPUS-NET

- 2000 USERS
- 100 Mbps ACCESS
- 400 Mbps PEAK
CAMPUS-NET UNIVERSITY OF TWENTE
MEASUREMENT SET-UP

CAMPUSNET

NETRAMET METER

CS EL ...

ADSL Cable Dial-in

Internet
WHAT DID WE MEASURE?

THE TOTAL TRAFFIC ON THE LINK

TRAFFIC FOR DESTINATIONS:
- INSIDE THE UNIVERSITY (CABLE / ADSL / DEPARTMENTS)
  - OUTSIDE THE UNIVERSITY

TOP-TALKERS
- INSIDE THE UNIVERSITY
- OUTSIDE THE UNIVERSITY
SYSTEM LOAD OF METER

system load vs. packet rate (10 min avg)
MEASURING LIMITS - CONCLUSIONS

CURRENT PCs CAN EASILY HANDLE 0.5 GIGABITS

WITH SOPHISTICATED NETWORK CARDS SPEEDS OF SEVERAL GIGABITS SEEM POSSIBLE
ISN’T THIS GREAT?

MEASUREMENT RESULTS CAN BE USED FOR DIMENSIONING

MEASUREMENT RESULTS CAN BE USED FOR ACCOUNTING

COMPANIES CAN TRACE TRAFFIC FROM EMPLOYEES

GOVERNMENTS CAN TRACE ALL TRAFFIC

AOL-WARNER CAN DETECT ILLEGAL MP3s

NEW LAWS (DMCA, HOWARD BERMAN , …)
MEASUREMENT RESULTS

UNIVERSITY OF TWENTE

- BANDWIDTH CONSUMPTION FOR TOP USERS
- BANDWIDTH CONSUMPTION FOR AVERAGE USERS
  - POPULAR PROTOCOLS / APPLICATIONS
  - EXCHANGE BETWEEN STUDENTS & TEACHERS

ABILENE BACKBONE OF INTERNET2

- POPULAR PROTOCOLS / APPLICATIONS
UNIVERSITY OF TWENTE: TOP USERS

Top 8 by volume, IF-MIB vs NeTraMet

- IF-MIB out
- IF-MIB in
- NeTraMet out
- NeTraMet in

Volume (bytes)
UNIVERSITY OF TWENTE: WHAT STUDENTS DO

Graph showing the usage of different services (All, HTTP, Kazaa, News, Mail) on different dates.

- 23-5-2002 18:35
- 24-5-2002 11:15
- 24-5-2002 14:00
- 25-5-2002 11:15
- 25-5-2002 16:25
UNIVERSITY OF TWENTE
EXCHANGES BETWEEN STUDENTS AND TEACHERS

File Sharing
139

File Sharing
445

Web

News

Total

 Students
 Teachers
ABILENE BACKBONE: POPULAR APPLICATIONS

Data collected: 04-03-2002 / 10-03-2002
http://netflow.internet2.edu/weekly/20020304/
ISN’T THIS GREAT?

IT IS SAFE TO ASSUME THAT BETWEEN 25 AND 75% OF ALL INTERNET TRAFFIC IS MP3, DIVX, ETC.

ACCORDING TO THE FCC IN THE U.S. THE NUMBER OF:
• BROADBAND USERS = 12.8 MILLION / GROWTH = 80.3%
• DSL USERS = 3.9 MILLION / GROWTH = 95%

INTERNATIONAL FEDERATION OF THE PHONOGRAPHIC INDUSTRY:
• IN 2001 BACK FROM 35.7 TO 33.7 BILLION DOLLAR
• SINGLES 16% DOWN, ALBUMS 5%

YANKEE GROUP:
• 2001: 5.16 / 2005: 7.44 / 2007: 3.9 BILLION ILLEGAL MUSIC DOWNLOADS

FORRESTER RESEARCH:
• 2007: ONLINE MUSIC MARKET MORE THAN 2 BILLION DOLLAR
LESSONS TO BE LEARNED

INTERNET IS HEAVILY USED FOR ILLEGAL CONTENT

MANY INDIVIDUALS EXCHANGE LARGE AMOUNTS OF TRAFFIC

NEXT GENERATION WIRELESS NETWORKS ARE NOT SUITED FOR THESE AMOUNTS

EXAMPLE: GPRS
COSTS GPRS

NETHERLANDS:
KPN: 2,25 EURO PER MB
VODAFONE: 1,50 PER MB

GERMANY:
E-PLUS: 25 EURO PER MB
VODAFONE: 1,90 EURO PER MB
COSTS GPRS

COSTS OF COPYING 1 CD
(600 MB)

900 EURO

DOWNLOAD TIME: 13 HOURS
TOP USERS - UNIVERSITY OF TWENTE

Top 8 by volume, IF-MIB vs NeTraMet
UNIVERSITY OF TWENTE

UT:
- 23 MEURO / WEEK
- 1200 MEURO / YEAR
CONCLUSION

MEASURING INTERNET TRAFFIC IS FUN!