

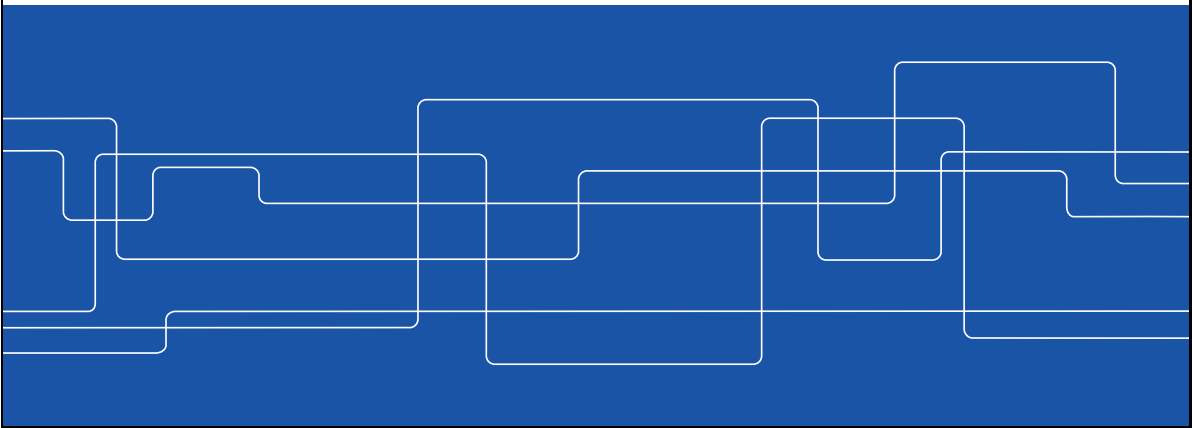
Slide 1



II2202: Presenting your data

prof. Gerald Q. Maguire Jr. <http://people.kth.se/~maguire/>

School of Information and Communication Technology (ICT), KTH Royal Institute of Technology
II2202 Fall 2015, Period 1 and Periods 1&2 2015.08.21 © 2015 G. Q. Maguire Jr. All rights reserved.



Slide 2



Presenting your data

1. Data visualization for **yourself** – to understand your data, to “listen to your data”, to exploit your data, ...
2. **Presenting it to your audience** – so that you can explain what you have found in the data, so that you can facilitate their understanding the data, so that they can make use of your data to build upon it, ...

PRESENTING YOUR DATA

II2202, FALL 2015

SLIDE 2

Slide 3



Presenting information with images

“A picture is worth a thousand words.”

-- Popular saying

Pictures, graphs, flow charts, UML, state machines, ... can convey an enormous amount of information if used well.

Consider “a wink” at a party

Slide 4



Why use graphical presentations?

- Very compact – you can present a lot of data in a small space – in contrast to a table
- To bring out difference and make comparisons
- To help abstract a general (abstract) “picture” (conception) from the data
- Many people are good at seeing **patterns** in visual scenes
- To achieve clarity and objectivity
- To support your text (i.e., to help you tell your story)

Slide 5



A graph is an encoding, when you look at it you need to visually decode it

“When a graph is made, quantitative and categorical information is encoded by a display method. Then the information is visually decoded. This visual perception is a vital link. No matter how clever the choice of the information, and no matter how technologically impressive the encoding, a visualization fails if the decoding fails. Some display methods lead to efficient, accurate decoding, and others lead to inefficient, inaccurate decoding. It is only through scientific study of visual perception that informed judgments can be made about display methods. The display methods of Elements rest on a foundation of scientific enquiry.”

From the preface of William S. Cleveland's
“The Elements of Graphing Data” [Cleveland 1989]

PRESENTING YOUR DATA

II2202, FALL 2015

SLIDE 5

[Cleveland 1989] William S. Cleveland, *The elements of graphing data*, 10.[print.] ed. Monterey, Cal: Wadsworth, 1989, ISBN: 978-0-534-03729-1.

[Cleveland 1993] William S. Cleveland, *Visualizing data*. Murray Hill, N.J. : [Summit, N.J: At&T Bell Laboratories ; Published by Hobart Press, 1993, ISBN: 978-0-9634884-0-4.

The R code for the figure is the book and the data tables can be found from <http://www.stat.purdue.edu/~wsc/visualizing.html>

Slide 6



Edward Tufte's books

Examples of how to present information well and even beautifully:

- Beautiful Evidence [Tufte 2006]
- The Visual Display of Quantitative Information [Tufte 2001]
- Visual Explanations: Images and Quantities, Evidence and Narrative [Tufte 1997]
- Envisioning Information [Tufte 2008]

<http://www.edwardtufte.com/tufte/index>

PRESENTING YOUR DATA

II2202, FALL 2015

SLIDE 6

[Tufte 2008] Edward Rolf Tufte, *Envisioning information*, 12. printing. Cheshire, Conn: Graphics Press, 2008, ISBN: 978-0-9613921-1-6.

[Tufte 1997] Edward R. Tufte, *Visual explanations: images and quantities, evidence and narrative*. Cheshire, Conn: Graphics Press, 1997, ISBN: 978-0-9613921-2-3.

[Tufte 2006] Edward R. Tufte, *Beautiful evidence*. Cheshire, Conn: Graphics Press, 2006, ISBN: 978-0-9613921-7-8.

[Tufte 2001] Edward R. Tufte, *The visual display of quantitative information*, 2nd ed. Cheshire, Conn: Graphics Press, 2001, ISBN: 978-0-9613921-4-7.

Slide 7



Measuring a FASP file transfer

Inspired by National Center for Biotechnology Information's 'Aspera Transfer Guide' [NCBI 2014]

Downloaded and installed Aspera Connect software from:
<http://downloads.asperasoft.com/connect2/>

Transferred a 1Gbyte test file – while collecting data using:
`tcpdump -l eth0 -w /tmp/xxxxxxx`

PRESENTING YOUR DATA

II2202, FALL 2015

SLIDE 7

[NCBI 2014] National Center for Biotechnology Information, 'Aspera Transfer Guide', *National Center for Biotechnology Information, U.S. National Library of Medicine*, 16-Apr-2014. [Online]. Available: <http://www.ncbi.nlm.nih.gov/books/NBK242625/>. [Accessed: 18-Aug-2015]

Slide 8



Start ascp to transfer 1G from test server

```
maguire@ccs2:~/aspera/connect/bin> ls
ascp asperaconnect asperaconnect.bin asperacrypt asunprotect plugins
maguire@ccs2:~/aspera/connect/bin> env ASPERA_SCP_PASS=demoaspera
./ascp -L -T -l100m aspera@demo.asperasoft.com:aspera-test-dir-large/1GB /tmp/
LOG Aspera Connect version 3.6.0.106805
```

```
LOG Alternate log directory: "-"
LOG Configuration: using v2 configuration file
"/home/maguire/.aspera/connect/etc/aspera.conf", user -
LOG Initializing FASP version 3.5.4.103990, license max rate=(unlimited), account
no.=1, license no.=1 product=6
LOG Configured symlink actions: create=1, follow=1, follow_wide=0, skip=0
LOG [asssh] remote host-key fingerprint f34dfcda4110604e4ecf53e6e18c6559a38cbb43
LOG [asssh] authentication succeeded, proceeding.
LOG changing session job size from 0 to 2 to match server configuration
```

-L- log to standard output
-T disable encryption
-l100m maximum bandwidth of request – in this case **100 Mbps**

Slide 9



FASP session starts

```
LOG FASP Session Start uuid=a9063e44-f785-4bca-8e71-3eaa20a64b32
op=recv status=started source=aspera-test-dir-large/1GB (1) dest=/tmp
source_prefix=- local=130.237.209.248:42132 peer=198.23.89.123:33001
tcp_port=22 os="Linux 3.7.10-1.45-desktop #1 SMP PREEMPT"
ver=3.5.4.103990 lic=6:1:1 peeros="Linux 2.6.32-504.3.3.el6.x86_64 #1 SMP
W" peerver=3.5.4.100392 peerlic=10:1:22001 proto_sess=20002
proto_udp=20000 proto_bwmeas=20000 proto_data=20008
LOG FASP Session Params uuid=a9063e44-f785-4bca-8e71-3eaa20a64b32
userid=0 user="aspera" targetrate=100000000 minrate=0 rate_policy=fair
cipher=none resume=0 create=0 ovr=1 times=0 precalc=yes mf=0 mf_path=-
mf_suffix=.aspera-inprogress partial_file_suffix=- files_encrypt=no
files_decrypt=no file_csum=none dgram_sz=0 prepostcmd=- tcp_mode=no
rtt_auto=yes cookie="-" vl_proto_ver=1 peer_vl_proto_ver=1 vl_local=0
vlink_remote=0 vl_sess_id=3840 srcbase=- rd_sz=0 wr_sz=0
cluster_num_nodes=1 cluster_node_id=0 range=0-0 keepalive=no
test_login=no proxy_ip=- net_rc_alg=alg_delay exclude_older/newer_than=0/0
LOG Measured pMTU: 1492 Bytes, start_brft: 174 ms
LOG datagram size 1492B, block size 1452B, path MTU 1492B
```

Slide 10



Intermediate output

```

1GB          0% 2904      --:-- LOG FASP Transfer Start uuid=a9063e44-f785-4bca-8e71-3eaa20a64b32 op=recv
status=started file="/tmp/1GB" size=1048576000 start_byte=0 rate=100.00Mbps loss=0.00 rexreqs=0 overhead=0 mtime="2014-04-10 19:49"
LOG Receiver bl t/o/r/d/ts=2223/2223/0/0/1970 rex_rtt l/h/s/o=0/0/174/8 ooo_rtt l/h/s/o=0/0/174/8 rate_rtt b/l/h/s/r/f=174/175/177/176/0/2 cti bm/bs=0/0
rex n/s/q/v/a/r=0/0/0/0/0 bl l/d/o/r/a/x/dl/df/dm/ds=0/0/0/0/0/0/0/0 disk l/h/b=0/1/0 vlink lq/lo/rq/ro=0/0/0/0 rate
t/m/c/n/vl/vr/r=100000000/0/59680000/59680000/100000000/100000000/100000000 prog t/f/e=3227796/3227796/1000221 rcvD=0
LOG Receiver DS Qs ds/n/rq/ao/ap/rd/ru/no/po/pc/do=1/0/0/0/0/1/0/0/0/0 Rs i/o=1/1 mgmt backlog i/s/n =
1GB          22% 221MB 97.3Mb/s 01:10 ETALOG Receiver bl t/o/r/d/ts=168010/168010/0/0/167517 rex_rtt l/h/s/o=0/0/174/8
ooo_rtt l/h/s/o=0/0/174/8 rate_rtt b/l/h/s/r/f=174/175/182/175/0/1 cti bm/bs=0/0 rex n/s/q/v/a/r=0/0/0/0/0 bl l/d/o/r/a/x/dl/df/dm/ds=0/0/0/0/0/0/0 disk
l/h/b=0/1/0 vlink lq/lo/rq/ro=0/0/0/0 rate t/m/c/n/vl/vr/r=100000000/0/100000000/100000000/100000000/100000000/100000000 prog
t/f/e=243950520/243950520/21060992 rcvD=0
LOG Receiver DS Qs ds/n/rq/ao/ap/rd/ru/no/po/pc/do=1/0/0/0/0/1/0/0/0/0 Rs i/o=1/1 mgmt backlog i/s/n =
1GB          45% 453MB 97.3Mb/s 00:48 ETALOG Receiver bl t/o/r/d/ts=336110/336110/0/0/335617 rex_rtt l/h/s/o=0/0/174/8
ooo_rtt l/h/s/o=0/0/174/8 rate_rtt b/l/h/s/r/f=174/174/182/176/0/1 cti bm/bs=0/0 rex n/s/q/v/a/r=0/0/0/0/0 bl l/d/o/r/a/x/dl/df/dm/ds=0/0/0/0/0/0/0 disk
l/h/b=0/1/0 vlink lq/lo/rq/ro=0/0/0/0 rate t/m/c/n/vl/vr/r=100000000/0/100000000/100000000/100000000/100000000/100000000 prog
t/f/e=488031720/488031720/41122269 rcvD=0
LOG Receiver DS Qs ds/n/rq/ao/ap/rd/ru/no/po/pc/do=1/0/0/0/0/1/0/0/0/0 Rs i/o=1/1 mgmt backlog i/s/n =
1GB          68% 686MB 97.3Mb/s 00:27 ETALOG Receiver bl t/o/r/d/ts=504210/504210/0/0/503717 rex_rtt l/h/s/o=0/0/174/8
ooo_rtt l/h/s/o=0/0/174/8 rate_rtt b/l/h/s/r/f=174/174/182/176/0/1 cti bm/bs=0/0 rex n/s/q/v/a/r=0/0/0/0/0 bl l/d/o/r/a/x/dl/df/dm/ds=0/0/0/0/0/0/0 disk
l/h/b=0/1/0 vlink lq/lo/rq/ro=0/0/0/0 rate t/m/c/n/vl/vr/r=100000000/0/100000000/100000000/100000000/100000000/100000000 prog
t/f/e=732112920/732112920/61183179 rcvD=0
LOG Receiver DS Qs ds/n/rq/ao/ap/rd/ru/no/po/pc/do=1/0/0/0/0/1/0/0/0/0 Rs i/o=1/1 mgmt backlog i/s/n =
1GB          91% 919MB 97.3Mb/s 00:07 ETALOG Receiver bl t/o/r/d/ts=672310/672310/0/0/671817 rex_rtt l/h/s/o=0/0/174/8
ooo_rtt l/h/s/o=0/0/174/8 rate_rtt b/l/h/s/r/f=174/174/182/175/0/1 cti bm/bs=0/0 rex n/s/q/v/a/r=0/0/0/0/0 bl l/d/o/r/a/x/dl/df/dm/ds=0/0/0/0/0/0/0 disk
l/h/b=0/1/0 vlink lq/lo/rq/ro=0/0/0/0 rate t/m/c/n/vl/vr/r=100000000/0/100000000/100000000/100000000/100000000/100000000 prog
t/f/e=976194120/976194120/81244539 rcvD=0
LOG Receiver DS Qs ds/n/rq/ao/ap/rd/ru/no/po/pc/do=1/0/0/0/0/1/0/0/0/0 Rs i/o=1/1 mgmt backlog i/s/n =
1GB          100% 1000MB 97.3Mb/s 01:26

```

Slide 11



FASP transfer stops

```
LOG FASP Transfer Stop uuid=a9063e44-f785-4bca-8e71-3eaa20a64b32 op=recv status=success file="/tmp/1GB"
size=1048576000 start_byte=0 rate=96.36Mbps elapsed=87.05s loss=0.00 rexreqs=0 overhead=0 mtime="2014-04-10
19:49"
LOG Receiver bl t/o/r/d/ts=722162/722160/0/2/722160 rex_rtt l/h/s/o=0/0/174/8 ooo_rtt l/h/s/o=0/0/174/8 rate_rtt
b/l/h/s/r/f=174/175/178/175/0/1 cti bm/bs=0/0 rex n/s/q/v/a/r=0/0/0/0/0/0 bl l/d/o/r/a/x/dl/df/dm/ds=0/0/0/0/2/0/0/0 disk
l/h/b=0/1/0 vlinc lq/ro/rq/ro=0/0/0/0 rate
t/m/c/n/vl/vr/r=1000000000/0/1000000000/1000000000/1000000000/1000000000/1000000000 prog
t/f/e=1048576000/1048576000/87494969 rcvD=1
LOG Receiver DS Qs ds/n/rq/ao/ap/rd/ru/no/po/pc/do=0/0/0/0/0/0/0/0/0/0 Rs i/o=1/1 mgmt backlog i/s/n =
Completed: 1024000K bytes transferred in 87 seconds
(95875K bits/sec), in 1 file.
LOG FASP Session Stop uuid=a9063e44-f785-4bca-8e71-3eaa20a64b32 op=recv status=success source=aspera-test-dir-
large/1GB (1) dest=/tmp source_prefix= local=130.237.209.248:42132 peer=198.23.89.123:33001 tcp_port=22 os="Linux
3.7.10-1.45-desktop #1 SMP PREEMPT" ver=3.5.4.103990 lic=6:1:1 peeros="Linux 2.6.32-504.3.3.el6.x86_64 #1 SMP W"
peerver=3.5.4.100392 peerlic=10:1:22001 proto_sess=20002 proto_udp=20000 proto_bwmeas=20000 proto_data=20008
LOG FASP Session Params uuid=a9063e44-f785-4bca-8e71-3eaa20a64b32 userid=0 user="aspera" targetrate=100000000
minrate=0 rate_policy=fair cipher=none resume=0 create=0 ovr=1 times=0 precalc=yes mf=0 mf_path=- mf_suffix= aspera-
inprogress partial_file_suffix= files_encrypt=no files_decrypt=no file_csum=none dgram_sz=0 prepostcmd=- tcp_mode=no
rtt_auto=yes cookie="" vl_proto_ver=1 peer_vl_proto_ver=1 vl_local=0 vlinc remote=0 vl_sess_id=3840 srcbase=-
rd_sz=0 wr_sz=0 cluster_num_nodes=1 cluster_node_id=0 range=0-0 keepalive=no test_login=no proxy_ip=-
net_rc_alg=alg_delay exclude_older/newer_than=0/0
LOG FASP Session Statistics [Receiver] id=a9063e44-f785-4bca-8e71-3eaa20a64b32 delay=176ms rex_delay=8ms
ooo_delay=8ms solicited_rex=0.00% rcvd_rex=0.00% rcvd_dups=0.00% ave_xmit_rate 98.63Mbps effective=100.00%
effective_rate=98.63Mbps (detail: good_bkls 722160 bl total 722162 bl orig 722160 bl rex 0 dup_bkls 0 dup_last_bkls 0
drop_bkls_xnf 2) (sndr cti: sent 112 rcvd 112 lost 0 lost 0.00%) (rcvr cti: sent 879 rcvd 877 lost 2 lost 0.23%) (rex cti: sent 0
rcvd 0 lost 0 lost 0.00%) (progress: tx_bytes 1048576000 file_bytes 1048576000 tx_time 87494969) rex_xmit_bkls 0
xmit_total 722162 rex_xmit_pct 0.00%
```

Completed: 1024000K bytes
transferred in 87 seconds
(95875K bits/sec), in 1 file

delay=176ms rex_delay=8ms
ave_xmit_rate **98.63Mbps**
(sndr cti: sent 112 rcvd 112 lost 0 lost 0.00%)
(rcvr cti: sent 879 rcvd 877 lost 2 lost 0.23%)

Slide 12



Final transfer statistics

```
LOG ===== File Transfer statistics =====
LOG ----- Source statistics -----
LOG Source argument scans attempted      :      1
LOG - Source argument scans completed    :      1
LOG Source path scans attempted          :      1
LOG - Source path scans failed           :      0
LOG - Source path scans skipped since irregular :      0
LOG - Source path scans excluded         :      0
LOG - Source directory scans completed    :      0
LOG - Source file scans completed         :      1
LOG Source directory creates attempted    :      0
LOG - Source directory creates failed     :      0
LOG - Source directory created or existed :      0
LOG Source file transfers attempted       :      1
LOG - Source file transfers failed        :      0
LOG - Source file transfers passed        :      1
LOG - Source file transfers skipped       :      0
LOG Source bytes transferred              : 1048576000
LOG ===== end File Transfer statistics =====
```

Slide 13



Wireshark: UDP conversion

client

server

A: 130.237.209.248:42132 ↔ B: 198.23.89.123:33001

Packets: 703,728 Bytes: 1,058,302,232

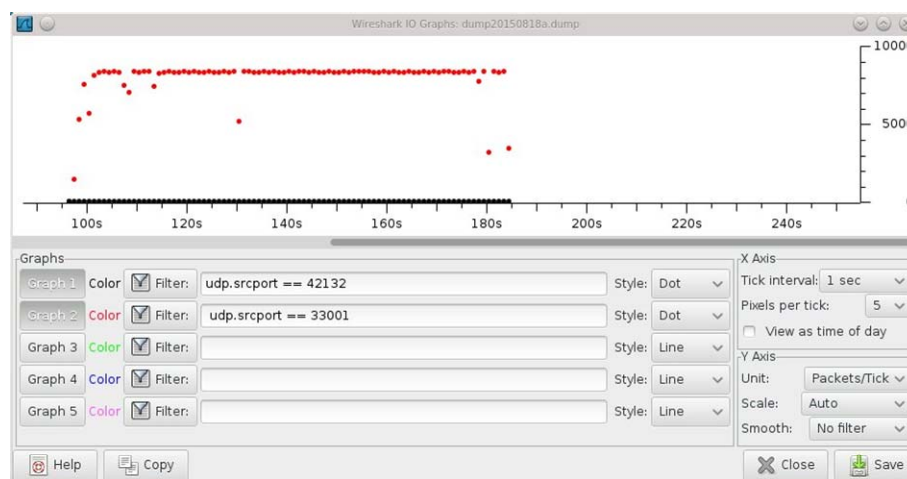
	Packets	Bytes	bps
A→B	961	88518	8,058.85
A←B	702,767	1,058,213,714	96,341,791.88

File size = 1,048,576,000 bytes

Slide 14



33001 is the source UDP port of server
42132 is the source UDP port of the client

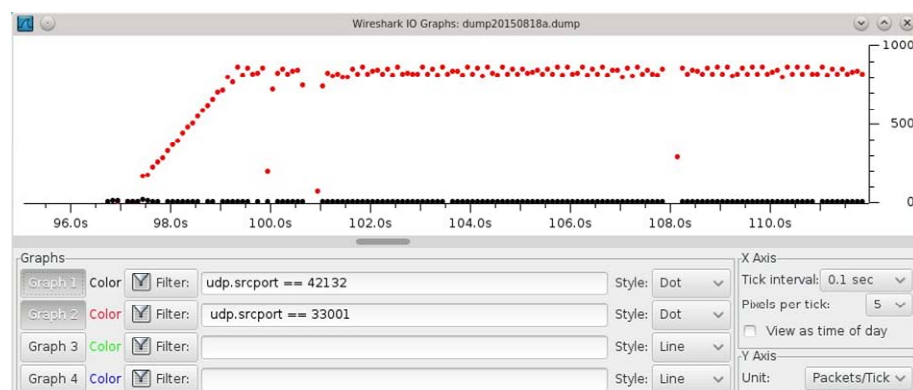


← Packet rate

Slide 15



33001 is the source UDP port of server
42132 is the source UDP port of the client

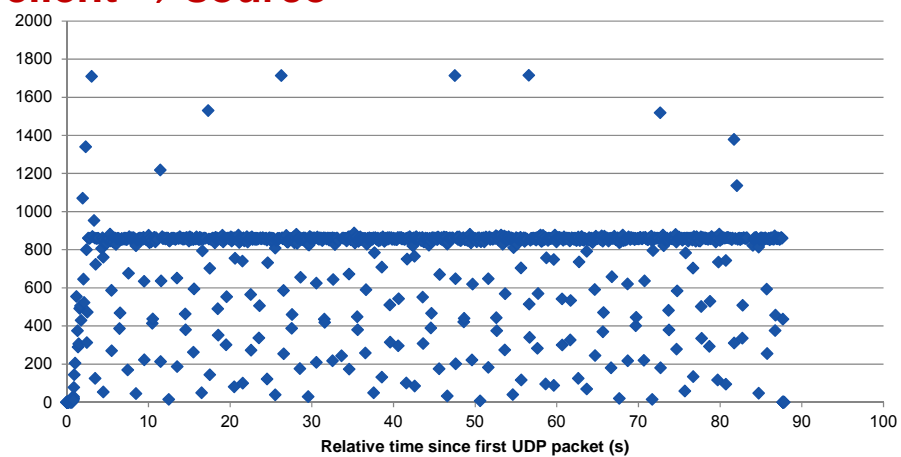


The first ~15 seconds of the transfer

Slide 16



Number of UDP packets from source \Rightarrow client since last UDP packet client \Rightarrow source

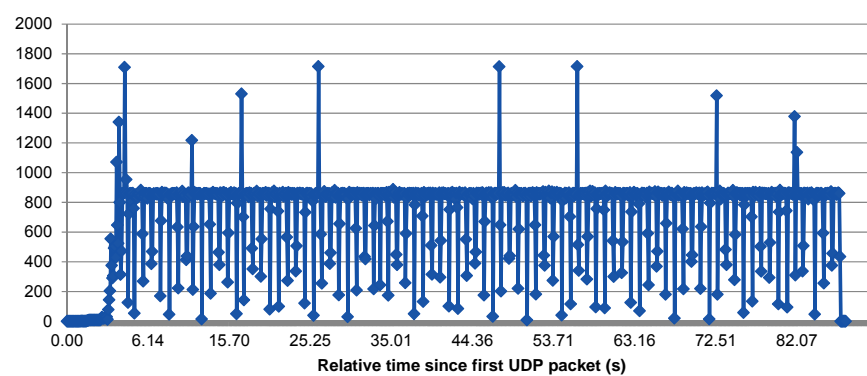


Slide 17



Connecting the points with lines to see their order

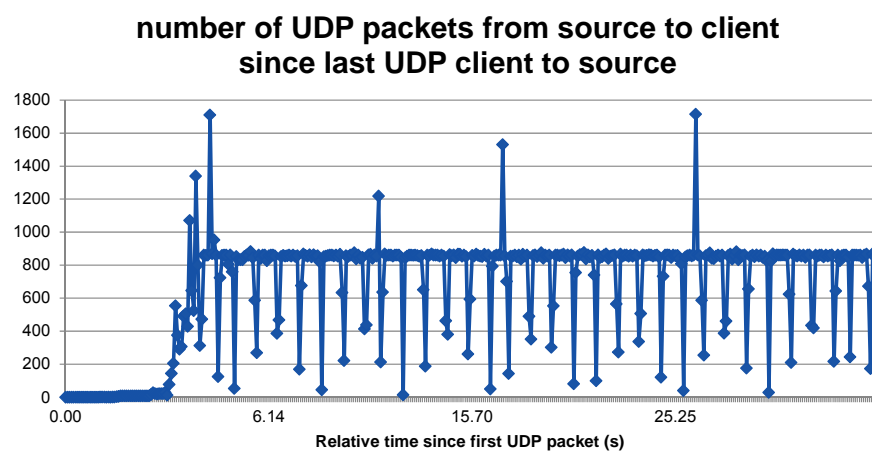
number of UDP packets from source to client
since last UDP client to source



Slide 18



Zooming in more we can see very periodic behavior

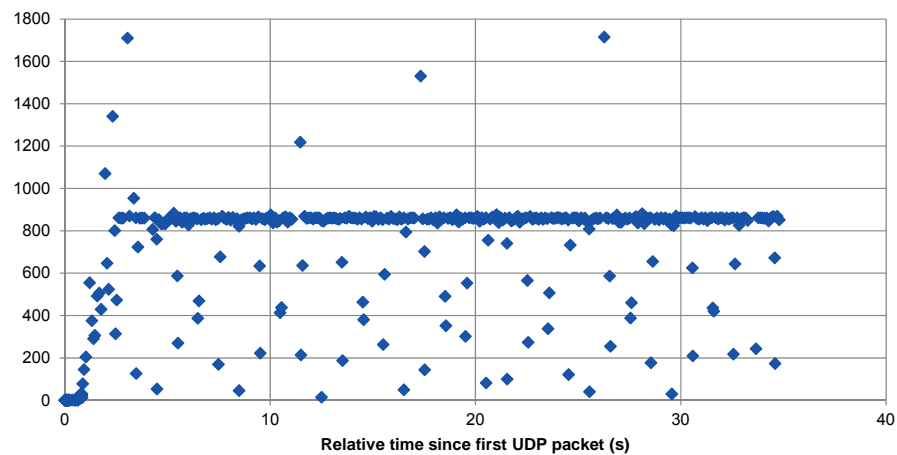


Showing only the first 330 bursts

Slide 19



Is the burst length periodicity a result of sever using different periodic processes that are out of phase wrt each others?



Showing only the first 330 bursts

Slide 20



Two sinograms – out of phase with each other – shaping the short burst lengths?

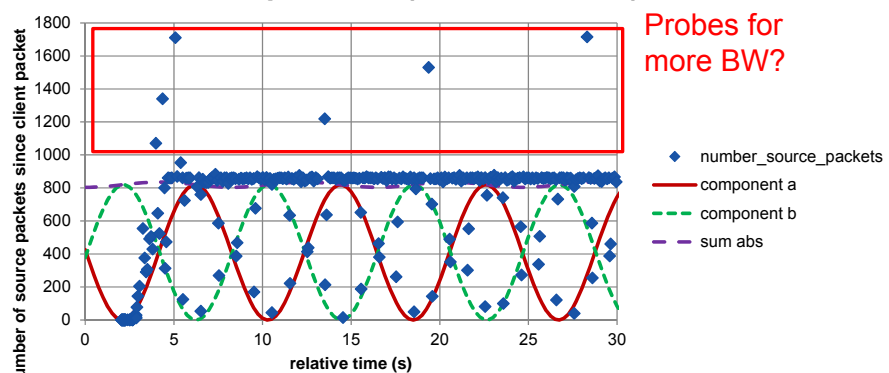
scale	410	410
v_offset	410	410
offset	4.05	8.1
frequency	0.121951	0.121951

1/8.2

median=857

963 bursts in ~90 s

Number source UDP
Packets per burst (first 330 values)



Shorter bursts to detect congestion or decrease in BW?

PRESENTING YOUR DATA

II2202, FALL 2015

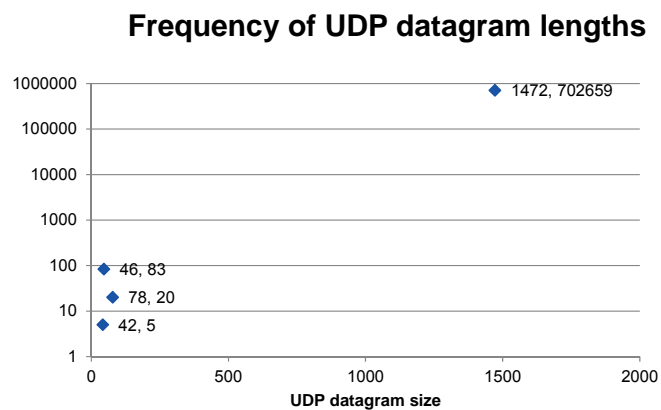
SLIDE 20

Slide 21



Source to client UDP 4 different datagram sizes

Bin	Frequency
42	5
46	83
78	20
1472	702659

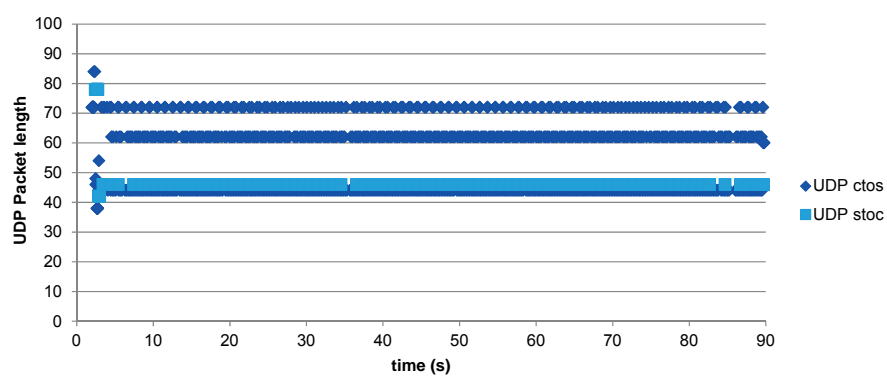


Slide 22



When are these shorter UDP datagrams sent?

UDP - excluding 1472 byte packets source to client



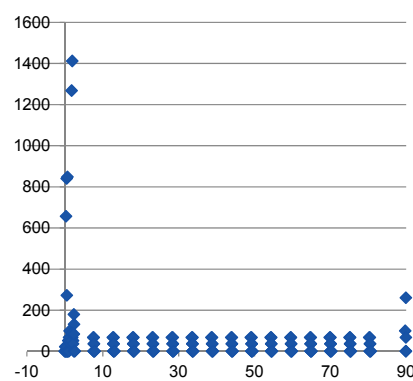
Even the source is regularly sending short datagrams!

Slide 23

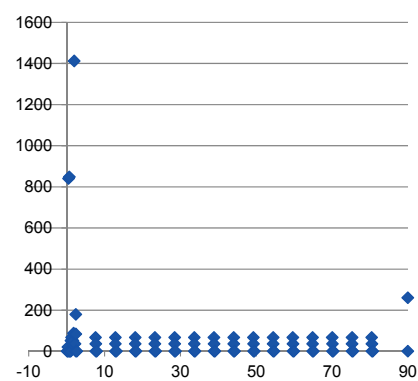


There is also TCP traffic

TCP c \Rightarrow s length versus time



TCP s \Rightarrow c length versus time

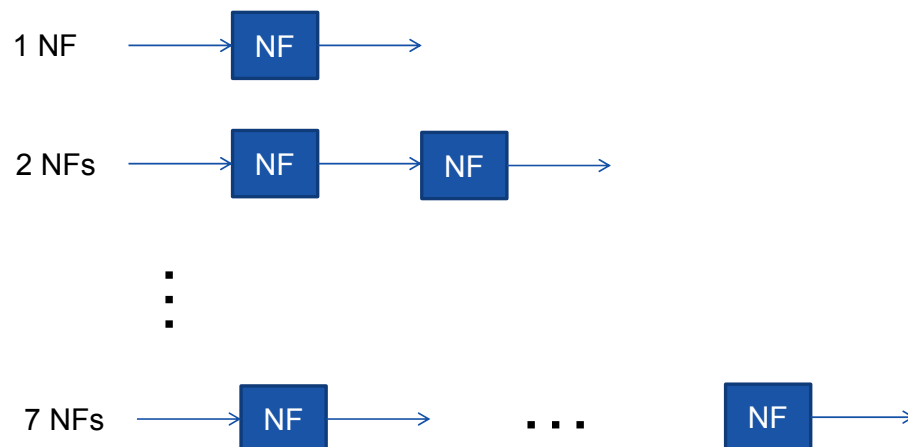


~5.196 s between bursts of TCP packets

Slide 24



Another experiment: Sending packets through chains of network functions

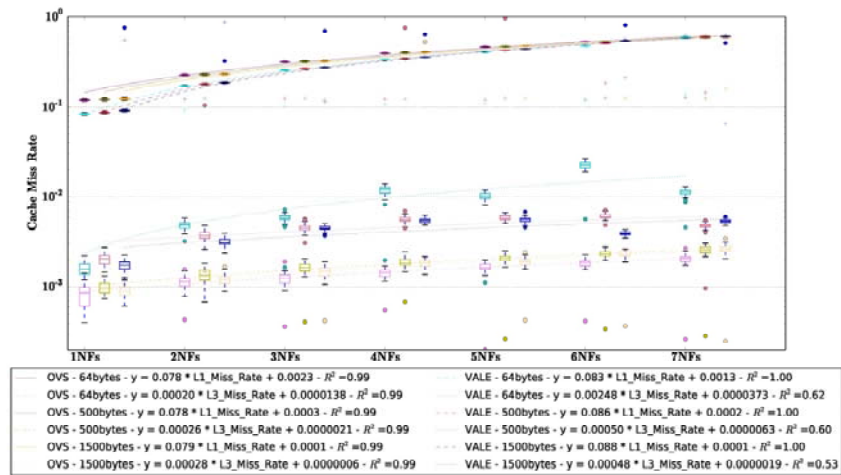


Slide 25



Importance of visualizing outliers

Cache miss rates as a function of the length of a chain of network functions



Data provided by Georgios Katsikas, doctoral student at Network Systems Lab (NSL), CoS

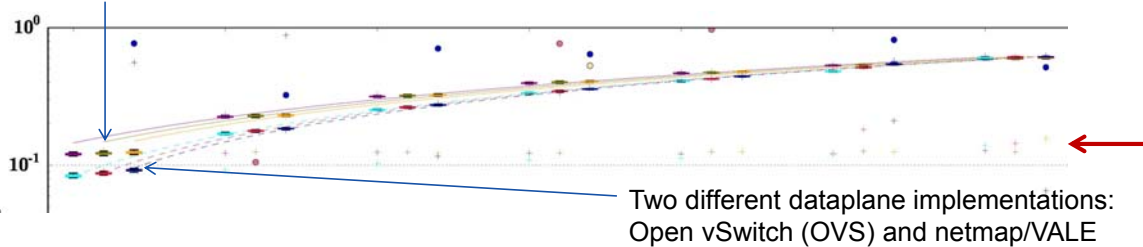
Slide 26



Importance of visualizing outliers

Zooming in on L1 cache miss rates as a function of the length of a chain

Three different lengths of packets (64, 500, 1500)



Two different dataplane implementations:
Open vSwitch (OVS) and netmap/VALE

OVS - 64bytes - $y = 0.078 * L1_Miss_Rate + 0.0023 - R^2 = 0.99$	VALE - 64bytes - $y = 0.083 * L1_Miss_Rate + 0.0013 - R^2 = 1.00$
OVS - 64bytes - $y = 0.00020 * L3_Miss_Rate + 0.0000138 - R^2 = 0.99$	VALE - 64bytes - $y = 0.00248 * L3_Miss_Rate + 0.0000373 - R^2 = 0.62$
OVS - 500bytes - $y = 0.078 * L1_Miss_Rate + 0.0003 - R^2 = 0.99$	VALE - 500bytes - $y = 0.086 * L1_Miss_Rate + 0.0002 - R^2 = 1.00$
OVS - 500bytes - $y = 0.00026 * L3_Miss_Rate + 0.0000021 - R^2 = 0.99$	VALE - 500bytes - $y = 0.00050 * L3_Miss_Rate + 0.0000063 - R^2 = 0.60$
OVS - 1500bytes - $y = 0.079 * L1_Miss_Rate + 0.0001 - R^2 = 0.99$	VALE - 1500bytes - $y = 0.088 * L1_Miss_Rate + 0.0001 - R^2 = 1.00$
OVS - 1500bytes - $y = 0.00028 * L3_Miss_Rate + 0.0000006 - R^2 = 0.99$	VALE - 1500bytes - $y = 0.00048 * L3_Miss_Rate + 0.0000019 - R^2 = 0.53$

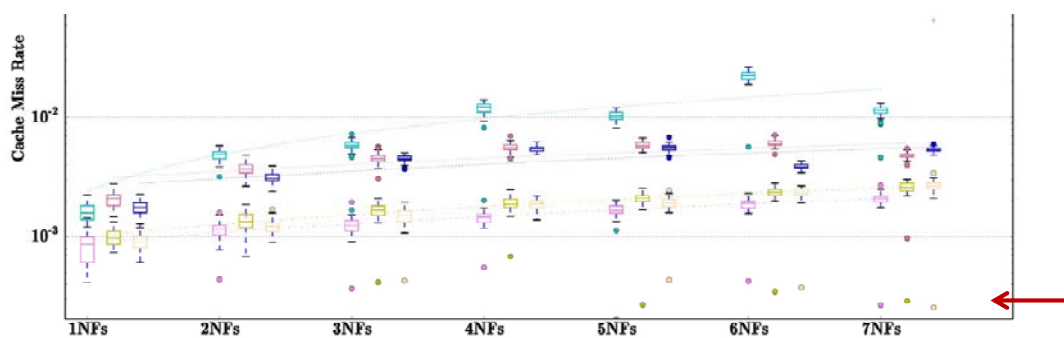
Data provided by Georgios Katsikas, doctoral student at Network Systems Lab (NSL), CoS

Slide 27



Importance of outliers

Zooming in on the lowest L3 miss rates – shows there are some that experience an order of magnitude lower cache miss rates. Why?



Data provided by Georgios Katsikas, doctoral student at Network Systems Lab (NSL), CoS

Slide 28



Lots of sources for more information

There are lots of different ways of presenting data graphically, see for example:

- Ray Lyons, 'Best Practices in Graphical Data Presentation', [Lyons 2010]
http://libraryassessment.org/bm~doc/workshop_lyons_ray.pdf
- Dona M. Wong, *The Wall Street journal guide to information graphics: the dos and don'ts of presenting data, facts, and figures* [Wong 2010] (Edward R. Tufte was her thesis advisor)

PRESENTING YOUR DATA

II2202, FALL 2015

SLIDE 28

[Lyons 2010] Ray Lyons, 'Best Practices in Graphical Data Presentation', Baltimore, MD, USA, 25-Oct-2010 [Online]. Available:
http://libraryassessment.org/bm~doc/workshop_lyons_ray.pdf. [Accessed: 18-Aug-2015]

[Wong 2010] Dona M. Wong, *The Wall Street journal guide to information graphics: the dos and don'ts of presenting data, facts, and figures*, 1st ed. New York: W.W. Norton & Co, 2010, ISBN: 978-0-393-07295-2.

Slide 29



References

- [Cleveland 1989] William S. Cleveland, *The elements of graphing data*, 10.[print.] ed. Monterey, Cal: Wadsworth, 1989, ISBN: 978-0-534-03729-1.
- [Cleveland 1993] William S. Cleveland, *Visualizing data*. Murray Hill, N.J. : [Summit, N.J: At&T Bell Laboratories ; Published by Hobart Press, 1993, ISBN: 978-0-9634884-0-4.
- [Lyons 2010] Ray Lyons, 'Best Practices in Graphical Data Presentation', Baltimore, MD, USA, 25-Oct-2010 [Online]. Available: http://libraryassessment.org/bm~doc/workshop_lyons_ray.pdf. [Accessed: 18-Aug-2015]
- [Tufte 2008] Edward Rolf Tufte, *Envisioning information*, 12. printing. Cheshire, Conn: Graphics Press, 2008, ISBN: 978-0-9613921-1-6.
- [Tufte 1997] Edward R. Tufte, *Visual explanations: images and quantities, evidence and narrative*. Cheshire, Conn: Graphics Press, 1997, ISBN: 978-0-9613921-2-3.
- [Tufte 2006] Edward R. Tufte, *Beautiful evidence*. Cheshire, Conn: Graphics Press, 2006, ISBN: 978-0-9613921-7-8.
- [Tufte 2001] Edward R. Tufte, *The visual display of quantitative information*, 2nd ed. Cheshire, Conn: Graphics Press, 2001, ISBN: 978-0-9613921-4-7.
- [Wong 2010] Dona M. Wong, *The Wall Street journal guide to information graphics: the dos and don'ts of presenting data, facts, and figures*, 1st ed. New York: W.W. Norton & Co, 2010, ISBN: 978-0-393-07295-2.

Slide 30



¿Questions?

PRESENTING YOUR DATA

II2202, FALL 2015

SLIDE 30