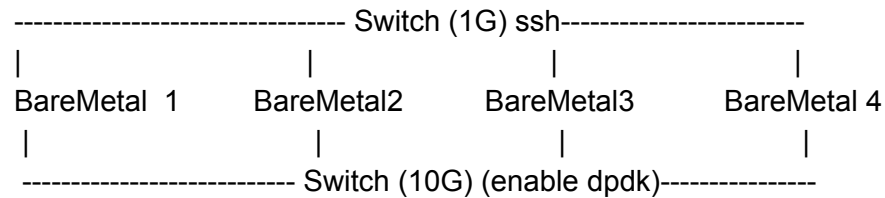


# HOMA - RAMCloud

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## Architecture



### Configurations:

Set up same username on all host machines.

Bare Metal servers used (4)  
 Intel(R) Xeon(R) CPU E7-8893 v3  
 3.20GHz  
 8 core  
 128 GB Memory

Switch:  
 1Gbps for ssh  
 10Gbps for setting up dpdk

Vlan configuration:  
 Vlan - 10.10.10.\*/24

Useful Links:

<https://ramcloud.atlassian.net/wiki/spaces/RAM/pages/6848614/General+Information+for+Devel+opers>  
<https://platformlab.stanford.edu/Presentations/2018/Yilong%20Li.pdf>

## Installation

### Packages to install

- build-essential
- doxygen
- libpcrc3-dev
- protobuf-compiler
- libprotobuf-dev
- libcrypto++-dev
- libevent-dev
- libboost-all-dev
- libgtest-dev
- libzookeeper-mt-dev
- zookeeper
- libssl-dev
- Openjdk-8
- Libstdc++6:i386
- Git
- Openssh-server

### Useful commands:

```
sudo apt-get install build-essential git-core doxygen libpcrc3-dev
protobuf-compiler libprotobuf-dev libcrypto++-dev libevent-dev
libboost-all-dev libgtest-dev libzookeeper-mt-dev zookeeper libssl-dev
```

```
sudo apt-get install git
```

```
sudo apt-get install libstdc++6:i386
```

```
sudo apt-get install openjdk-8-jdk
```

```
sudo apt-get purge openssh-server
```

```
sudo apt-get install openssh-server
```

## Set Java Path:

```
nano ~/.bash_profile
```

```
export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
```

```
export PATH=$PATH:/usr/lib/jvm/java-8-openjdk-amd64/bin
```

```
source ~/.bash_profile
```

## GCC version check:

Check different versions of GCC installed on your system

Useful command:

```
dpkg -l | grep gcc | awk '{print $2}'
```

RAMCloud with Homa supports gcc5, if gcc doesn't exist please install gcc5.

Make sure to have gcc-5 as gcc version

Useful command:

```
sudo rm /usr/bin/gcc
```

```
sudo rm /usr/bin/g++
```

```
sudo ln -s /usr/bin/gcc-5 /usr/bin/gcc
```

```
sudo ln -s /usr/bin/g++-5 /usr/bin/g++
```

## Dpdk installation:

Homa bypasses the kernel and uses dpdk.

Useful commands:

```
git clone http://dpdk.org/git/dpdk
```

```
# Build code
```

```
cd dpdk
```

```
make config T=x86_64-native-linuxapp-gcc
```

```
make
```

```
# Install kernel modules
```

```
sudo modprobe uio
```

```

sudo insmod build/kmod/igb_uio.ko
# Configure hugepages
echo 1024 | sudo tee /sys/kernel/mm/hugepages/hugepages-2048kB/nr_hugepages
sudo mkdir /mnt/huge
sudo mount -t hugetlbfs nodev /mnt/huge
# Bind secondary network adaptor
sudo ifconfig enp0s9 down
sudo ./usertools/dpdk-devbind.py --bind=igb_uio enp0s9
sudo ./usertools/dpdk-devbind.py --status

```

### Switch Access:

Make sure to have access to switch for setting up different priorities like hom, homa1, homa2, homa4 etc.,

Useful link: <https://platformlab.stanford.edu/Presentations/2018/Yilong%20Li.pdf>

## Recommended changes

### GNUmakefile:

Directory: RAMCloud

File: GNUmakefile

```
GLIBCXX_USE_CXX11_ABI ?= yes
```

### Git branch:

```
Git checkout branch of origin/homa-transport
```

### Adding hostnames:

```
# Sample /etc/hosts file
```

```
IP hostname
```

Useful link:

<https://askubuntu.com/questions/874724/ssh-could-not-resolve-hostname-server-name-or-service-not-known>

### Openssh server:

Make sure openssh server is running

```
sudo service ssh status
sudo service ssh start
```

Grant user permissions:

Edit the /etc/sudoers with following

```
simulation1 ALL = NOPASSWD: ALL
```

Make ssh passwordless (including self):

Homa script requires users to login without password

Add public key value to authorized\_keys

Useful link:

<https://www.tecmint.com/ssh-passwordless-login-using-ssh-keygen-in-5-easy-steps/>

Useful commands:

```
cat ~/.ssh/id_rsa.pub | ssh homa@IP_Server_1 'cat >> ~/.ssh/authorized_keys'
cat ~/.ssh/id_rsa.pub | ssh homa@IP_Server_2 'cat >> ~/.ssh/authorized_keys'
cat ~/.ssh/id_rsa.pub | ssh homa@IP_Server_3 'cat >> ~/.ssh/authorized_keys'
cat ~/.ssh/id_rsa.pub | ssh homa@IP_Server_4 'cat >> ~/.ssh/authorized_keys'
```

Make no host verification passwordless (including self):

Make host verification not a necessary step

Useful commands:

```
sudo nano /etc/ssh/ssh_config
```

```
*****Make sure you add at the bottom of the file *****
```

```
Host 172.17.0.*
```

```
StrictHostKeyChecking no
```

```
UserKnownHostsFile=/dev/null
```

Useful link: (Note: Think about security considerations)

<https://superuser.com/questions/125324/how-can-i-avoid-sshs-host-verification-for-known-hosts/125325>

## NFS Setup:

Homa requires the systems has nfs setup. A single mount point (server) can be created on one machine and replicated to other machines (clients). This makes sure all the log files are remotely accessible.

Useful link:

<https://www.digitalocean.com/community/tutorials/how-to-set-up-an-nfs-mount-on-ubuntu-14-04>

Useful Commands:

```
homa@homa1:~$ df -h
/dev/sdb4    328G  2.9G  309G   1% /home
homa@homa2:~$ df -h
10.145.94.33:/home/homa/platformlab 328G  2.9G  309G   1% /home/homa/platformlab

homa@homa3:~$ df -h
10.145.94.33:/home/homa/platformlab 328G  2.9G  309G   1% /home/homa/platformlab

homa@homa4:~$ df -h
10.145.94.33:/home/homa/platformlab 328G  2.9G  309G   1% /home/homa/platformlab
```

## Create replication files:

Homa requires the systems has replication files across systems.

Sample example :

```
touch /home/homa/platformlab/RAMcloud/rp1
touch /home/homa/platformlab/RAMcloud/rp2
```

Change the default\_disks argument in GNUmake file

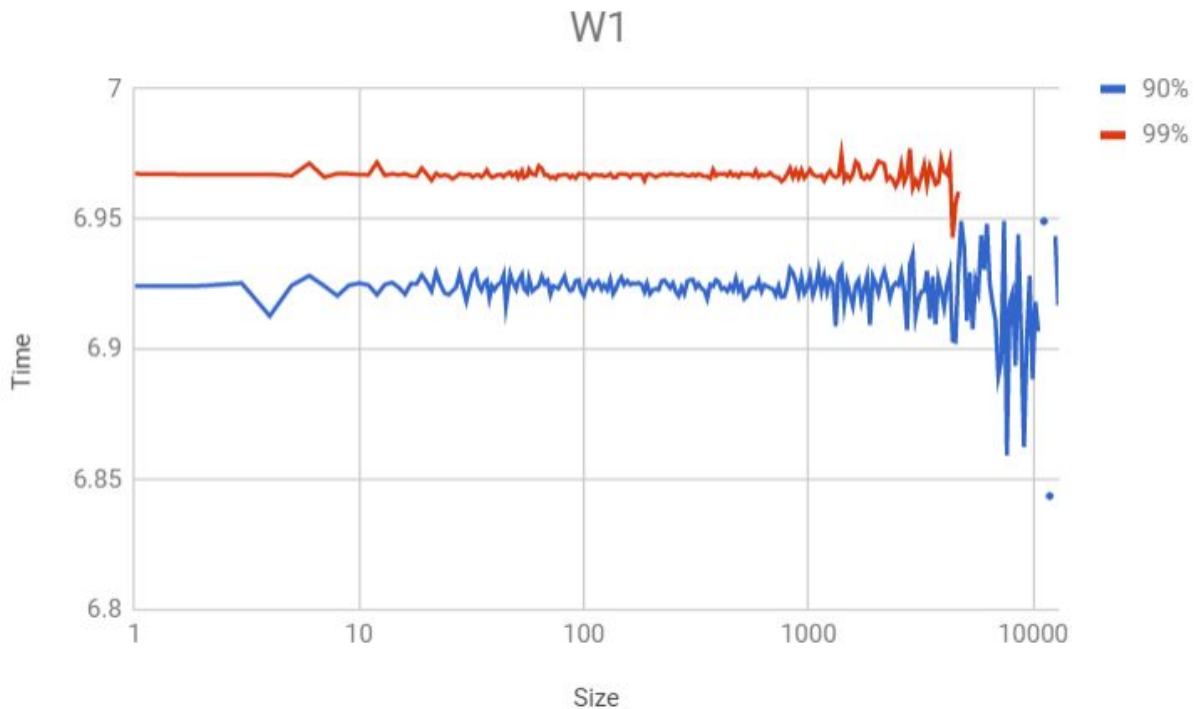
```
default_disks = '-f
/home/homa/platformlab/RAMcloud/rp1,/home/homa/platformlab/RAMcloud/rp2'
```

## Results

Following results are done with kernel.



## Homa+Udp : W1 load



```
homa@homa1:~/platformlab/RAMCloud$ scripts/clusterperf.py --transport homa+udp -r 0
--clients 3 --servers 1 --messageSizeCDF benchmarks/homa/messageSizeCDFs/W1.txt
--targetTput 1.0 echo_workload
```

```
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa1,10.145.94.33' (ECDSA) to the list of known hosts.
```

```
# Generated by 'clusterperf.py echoWorkload'
```

```
#
```

#	Size	Samples	Min	Median	90%	99%	99.9%	Max
#-----								
1	6810	2834.5	4713751.4	8399056.7	9276621.9	9501724.1	9549018.0	
2	211947	465.0	4740364.4	8402150.6	9270315.8	9522235.4	9550157.8	
3	109829	479.1	4757006.7	8421990.5	9270103.0	9521939.8	9550112.9	
4	206	4974.4	4617789.0	8180939.6	9272377.7	0.0	9276813.3	
5	32658	575.0	4753574.2	8404056.0	9261225.2	9528714.6	9550156.8	
6	768	3172.2	4780086.2	8477949.5	9363333.9	0.0	9542181.2	
7	7247	665.6	4748686.4	8400797.0	9248659.8	9514875.0	9546884.0	
8	289	7842.4	4004965.1	8328203.3	9278729.4	0.0	9441906.8	
9	9926	580.2	4663592.6	8405392.0	9276160.1	9530739.9	9546624.8	
10	9760	721.5	4759588.9	8421793.7	9270810.0	9512124.7	9547350.0	
11	106403	563.5	4764854.0	8407262.2	9268704.9	9526148.4	9550137.9	
12	1104	7631.3	4642111.2	8335853.4	9370995.2	9547622.0	9547622.8	
13	3832	882.6	4740079.5	8411124.4	9264455.9	9531383.6	9546625.1	
14	23392	715.5	4744335.4	8426467.6	9276642.6	9525440.4	9548756.8	
15	33771	471.4	4765460.1	8390211.3	9267740.0	9520651.9	9549918.1	
16	5864	2140.3	4670750.0	8339683.5	9276878.7	9532298.8	9549239.0	
17	2975	4446.4	4750689.5	8418588.4	9259014.1	9539403.0	9540981.5	
18	1555	582.2	4632458.5	8415343.0	9258229.5	9516534.2	9542190.9	
19	3249	747.5	4757631.5	8482958.2	9322746.4	9539627.8	9543960.7	
20	3409	2564.0	4718328.7	8428006.2	9272916.8	9533023.1	9545328.5	
21	1813	888.6	4910386.1	8363341.2	9223517.1	9517435.3	9544210.0	
22	3536	3173.2	4824952.2	8502136.9	9280967.1	9540567.8	9547365.3	
23	1916	3991.9	4766552.8	8411834.6	9257726.2	9484620.1	9520486.2	
24	3888	3245.3	4694930.0	8349228.2	9267477.8	9525004.5	9550138.7	
25	2073	2440.1	4682323.3	8335880.7	9260432.1	9480277.1	9534147.5	
26	2037	5653.1	4663045.6	8363578.5	9235576.1	9531385.5	9544373.8	
27	4257	639.9	4789788.3	8391057.4	9253809.8	9533837.9	9542170.6	
28	2165	3048.1	4789404.9	8489405.7	9278254.0	9529491.2	9548064.6	
29	2371	7825.1	4729576.3	8383298.6	9271787.9	9537540.1	9548562.5	
30	2325	882.2	4753311.4	8289343.1	9272657.8	9520979.7	9543802.9	
31	2467	599.7	4770589.2	8390811.8	9271899.6	9516549.3	9539638.3	
32	2502	1404.3	4849257.8	8484424.7	9250253.5	9515562.4	9539400.5	
33	2601	687.8	4878416.5	8514463.1	9265506.2	9542615.3	9547364.5	
34	2653	3587.0	4879243.7	8404491.3	9269605.5	9537327.1	9547849.8	
35	2656	1103.8	4881260.4	8368221.2	9251445.3	9536227.1	9540148.7	
36	2726	2060.6	4765350.1	8423269.0	9270036.3	9523546.3	9545125.4	
37	2765	1642.1	4764863.6	8442558.7	9306329.1	9542808.4	9547834.2	
38	2803	1465.4	4794039.1	8311023.2	9266471.3	9536603.5	9550138.6	
39	2883	680.4	4829012.8	8399606.3	9247566.2	9510074.7	9521759.8	
40	2988	478.8	4729343.4	8372286.8	9254237.4	9519109.2	9544606.4	
41	3021	1014.7	4704282.4	8400708.7	9266674.5	9519580.6	9540165.2	

43	3076	3875.0	4815202.0	8433766.7	9270813.6	9532552.5	9541678.3
44	3123	3181.5	4721880.2	8483015.0	9252275.5	9520477.1	9548286.2
45	3151	3679.9	4664743.4	8255305.3	9270810.9	9504836.0	9543805.3
47	3340	625.8	4862657.7	8487012.7	9288485.8	9535758.2	9543805.5
48	3376	1060.8	4893674.8	8438407.8	9260029.3	9474876.8	9532300.7
50	3499	606.9	4699277.5	8378097.4	9286080.9	9499093.6	9541670.4
51	3589	1076.1	4768158.1	8434348.2	9246415.2	9507452.1	9546869.2
53	3652	486.7	4770882.8	8485576.0	9300290.8	9516563.7	9542612.9
54	3682	1104.1	4752359.5	8383026.5	9245609.0	9507895.3	9539628.1
56	3766	1102.2	4765364.0	8352712.6	9260010.2	9530118.4	9546108.0
57	3775	1213.3	4793427.9	8454468.4	9313204.0	9529467.7	9542171.4
59	3914	2928.0	4780942.3	8362843.5	9274802.1	9534321.7	9547594.3
61	3951	1740.9	4761812.9	8385081.2	9266964.6	9531081.3	9546119.1
63	4102	1407.7	4656110.4	8403506.1	9341183.1	9529656.7	9549219.6
65	4122	2237.6	4758451.8	8472207.0	9319715.2	9537328.1	9548066.1
67	4130	1372.1	4765526.9	8416544.1	9265721.5	9536429.0	9544374.9
69	4242	2308.2	4696923.6	8439141.0	9267560.3	9515113.9	9548573.5
71	4324	1571.3	4703346.2	8338327.9	9241663.5	9525678.3	9543783.7
73	4513	977.8	4674501.3	8401911.4	9254054.8	9508475.6	9544176.8
75	4394	3121.6	4744691.1	8392646.7	9236782.2	9515558.9	9546282.9
77	4459	729.2	4727454.6	8382217.3	9266393.3	9530332.4	9542611.2
79	4680	1879.9	4764564.7	8419835.6	9264758.8	9519734.6	9548748.6
82	4666	753.7	4681068.5	8472083.8	9271208.9	9533603.9	9544193.6
84	4818	484.6	4749787.5	8404056.6	9270325.6	9512838.8	9534810.5
87	4795	4220.8	4681805.4	8364631.9	9245411.0	9541890.3	9549231.1
89	4933	1524.1	4700285.8	8372741.8	9262835.2	9504909.3	9534573.7
92	5015	2912.7	4794060.7	8439666.1	9240988.4	9480507.8	9549448.1
95	5192	731.0	4734646.5	8445153.7	9278435.3	9535757.4	9550137.5
97	5146	712.3	4684174.7	8367283.2	9272590.1	9530726.6	9548747.8
100	5039	962.1	4759413.9	8331243.5	9274075.9	9528533.3	9549434.8
103	5310	693.0	4704757.1	8405133.3	9271358.9	9535097.6	9547129.3
106	5222	1170.6	4850537.0	8438615.1	9242536.2	9519091.4	9541678.6
110	5404	4084.1	4673621.9	8382787.5	9271124.8	9514587.5	9548745.2
113	5480	1396.8	4814236.5	8420389.2	9270330.3	9510098.0	9549457.6
116	5585	596.1	4734450.3	8436089.6	9264011.9	9537118.9	9549237.4
120	5543	790.1	4770654.7	8376354.3	9267607.2	9527578.4	9547111.4
123	5722	773.8	4787949.3	8407997.7	9255425.2	9528716.8	9548086.2
127	5746	1990.1	4788495.1	8371666.4	9260081.1	9528545.4	9546408.7
131	5780	2104.4	4755115.4	8447697.9	9276386.1	9537326.3	9544178.1
135	5751	1155.5	4738090.1	8342780.1	9247889.8	9484089.6	9548560.9
139	5786	1499.8	4653645.3	8380947.7	9246400.4	9473444.1	9548283.2
143	5941	962.4	4787294.4	8432965.9	9274865.3	9532097.5	9545323.5
147	5964	569.5	4841344.9	8464539.0	9273469.4	9518165.6	9548065.9

151	5935	2689.7	4788931.8	8411095.3	9273351.4	9529644.1	9546426.2
156	5995	3090.9	4695056.5	8439796.4	9271970.3	9515305.5	9541900.3
161	6079	2071.8	4769207.4	8411095.9	9249711.7	9518592.8	9548061.5
165	6031	1192.7	4786267.8	8421157.5	9272138.5	9516788.2	9550113.3
170	6157	1756.0	4723550.4	8416040.9	9269649.2	9522265.0	9542173.2
175	6137	888.1	4705737.5	8424096.9	9271981.9	9527588.9	9548585.8
181	6123	653.8	4815927.2	8409813.7	9266718.6	9527808.3	9549904.7
186	6080	2521.1	4792038.5	8358255.9	9221427.5	9509903.5	9549906.3
191	6199	2045.3	4709001.1	8418211.2	9272031.7	9514728.5	9543313.9
197	6179	618.1	4667415.9	8342682.2	9274977.8	9530954.3	9550111.7
203	6155	1524.7	4728396.4	8371470.5	9263464.5	9535567.4	9549926.4
209	6188	592.9	4830370.0	8379639.2	9249711.0	9506068.4	9547592.7
215	6247	2360.9	4707438.2	8372470.1	9262648.5	9533023.5	9550138.2
222	6120	2060.2	4802438.7	8436447.5	9271897.9	9513147.7	9544607.8
228	6158	1340.0	4765400.9	8444101.8	9273351.1	9520011.2	9542805.8
235	6341	632.1	4756847.0	8415274.5	9266784.7	9530711.7	9547859.5
242	6387	713.4	4786225.6	8386801.1	9277780.8	9528023.5	9548562.7
249	6128	3442.5	4662758.5	8421522.4	9273343.5	9515081.9	9549927.3
257	6114	646.5	4696697.3	8355765.7	9267712.9	9534602.2	9550137.2
264	6015	652.5	4776420.1	8328608.8	9264752.2	9511065.3	9547849.6
272	6132	552.3	4781995.9	8391983.4	9275922.3	9531567.2	9544208.7
280	6149	625.2	4686540.5	8343356.8	9269784.7	9522418.3	9549448.3
289	5958	2133.5	4792204.3	8436731.5	9260080.4	9524790.0	9549240.8
297	5966	722.9	4852434.7	8446552.3	9259714.2	9525000.4	9542610.5
306	6013	705.6	4722065.2	8446250.1	9274625.7	9528986.5	9549223.2
315	5928	774.5	4785989.0	8386745.7	9258840.4	9487408.1	9546867.7
324	5771	1537.3	4746409.6	8416960.1	9275884.6	9529470.1	9548746.0
334	5750	861.7	4742701.7	8383757.5	9266236.4	9525001.3	9546427.7
344	5685	1153.5	4824804.4	8366651.8	9255633.6	9518135.5	9547833.4
354	5575	780.5	4723947.2	8308244.8	9255823.1	9479129.9	9541888.8
365	5572	4034.3	4709457.6	8410445.3	9241670.8	9530105.6	9548744.6
376	5486	591.2	4766797.4	8398788.6	9309984.5	9532098.2	9545789.6
387	5515	854.6	4702475.2	8446281.5	9260153.0	9516336.8	9539650.8
398	5338	1554.6	4659440.5	8431888.0	9276017.6	9520015.0	9544886.0
410	5189	2861.7	4710263.8	8376910.3	9273843.5	9516533.9	9540284.2
422	5125	574.0	4827640.9	8387795.9	9277622.3	9532316.4	9548281.9
435	5002	2147.8	4747805.6	8361867.0	9261017.6	9529490.3	9544888.1
448	5067	1180.7	4756271.0	8405053.5	9291482.2	9537327.4	9548062.9
461	4865	3019.5	4728003.0	8369423.1	9262210.2	9519108.2	9548085.4
475	4774	1645.7	4788943.5	8454031.6	9274259.9	9529466.9	9546624.0
489	4774	643.4	4765785.4	8367602.3	9251716.7	9528716.7	9547623.1
503	4588	1103.1	4735488.7	8409377.8	9281241.4	9508475.9	9544607.8
518	4487	754.7	4685928.7	8308200.5	9270903.3	9502118.5	9547349.7

534	4322	2104.1	4686448.1	8332522.9	9275161.8	9513343.7	9543795.4
549	4202	1940.6	4661473.6	8381641.7	9271680.8	9519092.9	9547592.3
566	4094	1962.9	4831224.2	8391049.4	9257677.6	9462429.7	9530548.9
582	4106	1718.6	4703813.1	8382922.7	9301443.2	9529641.6	9549017.5
600	3951	4161.9	4689264.2	8440203.1	9250885.1	9505076.2	9539842.5
618	3822	504.4	4751868.5	8361760.7	9273224.6	9533124.0	9539400.0
636	3660	4122.9	4628337.5	8409765.8	9261131.5	9506529.5	9537535.3
655	3588	3809.3	4734631.2	8397755.1	9266429.2	9518302.6	9547834.3
674	3452	4083.1	4746828.4	8385177.5	9285438.8	9501662.7	9528999.3
694	3474	868.0	4866978.1	8378748.3	9261937.4	9515082.2	9547348.2
715	3336	634.1	4770602.0	8332775.8	9250158.2	9543312.4	9549016.0
736	3215	641.0	4621666.6	8399611.1	9246076.4	9500045.9	9538691.4
758	3052	627.0	4720735.2	8318735.0	9214610.7	9453175.6	9548561.7
780	2925	1661.2	4769222.4	8322573.4	9233607.1	9497869.7	9522694.8
804	2936	3020.4	4768477.9	8398286.7	9276100.8	9541244.0	9549433.4
827	2697	1062.2	4659911.5	8529843.3	9321378.8	9535762.1	9546623.0
852	2732	5086.8	4813942.0	8497589.5	9249036.8	9518302.2	9545114.0
877	2573	3300.8	4775694.1	8434281.9	9303747.9	9521095.0	9536632.1
903	2396	3344.5	4717264.3	8344394.5	9245237.2	9536837.5	9548283.8
930	2384	6353.0	4753802.6	8461742.6	9306809.1	9540150.2	9540763.4
958	2283	1274.9	4714788.7	8347759.0	9242842.4	9509846.0	9533602.9
986	2156	5608.7	4849089.5	8388368.8	9274008.0	9531815.1	9540565.8
1015	2134	1378.0	4870255.9	8476967.4	9311841.9	9527812.5	9549909.8
1046	2072	1349.5	4584737.9	8333199.9	9272128.2	9517716.2	9520184.4
1077	1912	6278.2	4627402.8	8401200.0	9258421.1	9520497.5	9535281.1
1108	1859	2617.7	4983441.2	8520839.1	9255067.0	9536836.8	9548585.3
1141	1695	1451.6	4684467.8	8370861.0	9264011.3	9455901.7	9508218.7
1175	1680	4922.0	4710964.0	8474115.4	9221141.2	9499771.8	9533836.9
1210	1635	698.7	4602175.0	8359708.0	9268517.2	9521562.7	9534323.9
1246	1541	2377.0	4755360.1	8450252.0	9300311.4	9525005.1	9536208.7
1283	1501	31982.2	4700941.9	8419281.4	9262701.1	9521939.5	9541887.1
1321	1431	4360.6	4558240.8	8105201.1	9247920.3	9542345.7	9543787.1
1360	1334	2167.4	4622130.0	8498810.7	9262312.7	9528987.1	9535544.9
1401	1279	1556.9	4817166.8	8539695.9	9436508.9	9538290.4	9540981.9
1442	1217	8926.7	4696809.4	8266765.0	9226922.5	9497635.9	9528558.9
1485	1201	4583.1	4835842.1	8429045.8	9267400.8	9532782.0	9549017.8
1529	1083	1484.4	4663506.5	8337953.7	9231729.5	9477309.7	9516036.4
1574	1048	6861.3	4781830.4	8255956.4	9273399.9	9491520.3	9509117.7
1621	987	4895.3	4811001.7	8406258.4	9377629.9	0.0	9521564.2
1669	962	16084.2	4807334.5	8444031.1	9353111.4	0.0	9538007.9
1719	919	8721.7	4723230.6	8288353.9	9252630.7	0.0	9547108.1
1770	845	10001.9	4699096.1	8381295.4	9234371.2	0.0	9471812.5
1822	805	12222.1	4840693.3	8467468.3	9265849.0	0.0	9538690.8

1876	731	4928.2	4636585.3	8114474.9	9239507.5	0.0	9542808.6
1932	730	656.2	4811202.1	8469989.8	9272397.0	0.0	9525681.6
1989	694	35762.3	4964201.0	8417852.8	9326819.6	0.0	9546865.8
2048	634	3974.6	4672103.8	8345458.0	9381096.4	0.0	9527369.3
2109	635	2705.4	5009007.2	8447639.0	9367073.8	0.0	9529173.5
2172	560	3949.5	4762534.6	8512538.2	9357765.4	0.0	9508633.4
2236	538	4668.5	4663985.6	8425601.4	9228642.4	0.0	9534126.3
2303	474	3956.7	4764659.8	8311570.0	9255065.6	0.0	9524533.6
2371	455	15480.0	4524001.8	8392547.3	9227824.9	0.0	9438288.7
2441	438	571.8	4898849.7	8423318.1	9175641.6	0.0	9544175.0
2514	427	20626.5	4675317.3	8406426.4	9224203.9	0.0	9395824.8
2588	396	3764.0	4950634.3	8497089.3	9350552.9	0.0	9549652.2
2665	350	18499.7	4714231.8	8363264.1	9209720.2	0.0	9531382.1
2744	359	11482.2	4166676.2	8079115.9	9268147.8	0.0	9441740.9
2826	299	4476.8	4766182.4	8562531.6	9486927.6	0.0	9525953.1
2909	298	31205.6	4813554.0	8637300.9	9162979.0	0.0	9247600.9
2996	286	18484.1	4627270.3	8180667.1	9222284.2	0.0	9417873.9
3085	274	1155.1	4895864.5	8295999.3	9171226.6	0.0	9469465.0
3176	247	2748.7	4572950.8	8358255.7	9255587.9	0.0	9474179.9
3270	253	18821.0	4969167.8	8363002.1	9349633.8	0.0	9382481.6
3367	236	102899.6	4660956.4	8514477.9	9189941.1	0.0	9365650.4
3467	189	30415.7	4435459.2	8161002.6	9337443.1	0.0	9451110.2
3570	190	56866.7	4693104.8	8470624.1	9269210.2	0.0	9273059.6
3676	194	2845.4	4625978.9	8121542.9	9191243.2	0.0	9515561.8
3785	169	11081.0	4982748.4	8452529.4	9206713.2	0.0	9278392.4
3897	137	15011.9	5219275.3	8361119.5	9395332.9	0.0	9459937.6
4013	150	86088.8	4181723.1	8247113.3	9298084.1	0.0	9429371.4
4132	137	133516.5	5316286.1	8410907.3	9273569.1	0.0	9278229.3
4255	132	54411.4	4713976.3	8501743.5	9372276.2	0.0	9472812.8
4381	107	49643.8	4607980.4	8005326.9	8769486.2	0.0	8971208.8
4511	104	10399.9	4801119.4	7997653.6	9036217.5	0.0	9546098.1
4645	101	49042.0	4673821.2	8533421.9	9130722.1	0.0	9153534.1
4782	88	16498.4	5799352.3	8896957.3	0.0	0.0	9255247.8
4924	93	138063.8	5454187.6	8699427.7	0.0	0.0	9267397.5
5070	89	41657.3	4494692.7	8145646.6	0.0	0.0	9101530.7
5221	94	32278.1	5359443.2	8503728.3	0.0	0.0	9356837.9
5376	74	78583.2	4871662.9	8084187.7	0.0	0.0	9166449.3
5535	74	20824.6	5355104.1	8441721.4	0.0	0.0	9122845.9
5699	66	137660.3	4434766.5	8362025.2	0.0	0.0	9475485.8
5868	50	21917.8	5055557.3	8787082.7	0.0	0.0	9228746.9
6043	71	132944.3	5189549.7	8521450.8	0.0	0.0	9526442.8
6222	55	11922.4	4800303.1	8875130.4	0.0	0.0	9178010.4
6406	54	103220.3	4177740.5	8417367.2	0.0	0.0	8839984.3

6596	40	140553.1	4420951.2	8271128.7	0.0	0.0	8932832.0
6792	51	119271.6	5647822.7	8150423.1	0.0	0.0	9262703.9
6994	32	51941.9	3332078.9	7756000.5	0.0	0.0	9468273.0
7201	32	16136.8	5090638.5	7861583.3	0.0	0.0	9245495.3
7415	32	315640.7	5288904.2	8898856.1	0.0	0.0	9238897.8
7635	38	97299.1	4865850.4	7231244.6	0.0	0.0	9001598.5
7861	34	70132.4	4808724.9	8274966.3	0.0	0.0	8941883.1
8094	30	9585.2	4593403.2	8351850.9	0.0	0.0	9221279.5
8334	24	160069.9	5304501.3	7826250.9	0.0	0.0	8902039.7
8582	17	782294.9	6846795.4	8795021.4	0.0	0.0	9088471.8
8836	30	189730.9	4494674.0	8050481.2	0.0	0.0	8771365.2
9098	13	2544903.6	5204600.8	7284075.6	0.0	0.0	8640215.8
9368	19	1223802.9	5470689.1	8032315.6	0.0	0.0	9511855.3
9646	29	48889.6	5276321.4	8478363.2	0.0	0.0	9524325.4
9932	14	47041.6	5922480.0	7734018.2	0.0	0.0	7774391.5
10227	15	525696.1	6106200.9	8284128.6	0.0	0.0	8505785.5
10530	15	27037.6	6455527.7	8069582.8	0.0	0.0	8248988.2
10843	5	1092733.9	4943897.4	0.0	0.0	0.0	7497684.2
11164	11	401890.7	3734141.0	8895212.3	0.0	0.0	9440294.1
11496	8	3193889.8	7991367.9	0.0	0.0	0.0	8311221.6
11837	11	1353843.9	5551665.8	6976727.4	0.0	0.0	8785409.0
12188	7	673505.0	1990030.6	0.0	0.0	0.0	6959464.2
12549	10	1135542.1	5035985.3	8780417.5	0.0	0.0	8780417.5
12922	10	1048175.2	5201155.6	8258900.7	0.0	0.0	8258900.7
13305	5	919177.9	6800082.5	0.0	0.0	0.0	8368537.6
13700	5	1199241.9	5528266.1	0.0	0.0	0.0	9166565.3
14106	6	641385.5	3780234.5	0.0	0.0	0.0	9246370.1
14524	3	3065063.0	4060544.3	0.0	0.0	0.0	5031854.3
14955	3	3671614.9	4433204.9	0.0	0.0	0.0	5679994.3
15399	5	209910.2	6938522.2	0.0	0.0	0.0	9089355.7
15856	3	1893576.7	4698909.2	0.0	0.0	0.0	7598812.7
16326	2	1160217.3	7039997.3	0.0	0.0	0.0	7039997.3
16810	4	5729336.2	7129827.8	0.0	0.0	0.0	8269306.0
17309	1	6191229.2	6191229.2	0.0	0.0	0.0	6191229.2
17822	6	131548.9	7023874.5	0.0	0.0	0.0	7203589.5
18896	3	8399036.9	8403437.9	0.0	0.0	0.0	8496117.0
20033	1	434546.9	434546.9	0.0	0.0	0.0	434546.9
20627	2	5108490.5	5203085.8	0.0	0.0	0.0	5203085.8
21239	1	5463478.7	5463478.7	0.0	0.0	0.0	5463478.7
21869	1	314854.2	314854.2	0.0	0.0	0.0	314854.2
22518	4	759056.6	5414947.6	0.0	0.0	0.0	8391365.6
23186	3	1009101.4	4810288.0	0.0	0.0	0.0	7002471.6
23874	2	6924686.0	9502840.9	0.0	0.0	0.0	9502840.9

24582	1	8813885.4	8813885.4	0.0	0.0	0.0	8813885.4
25311	1	7829853.3	7829853.3	0.0	0.0	0.0	7829853.3
26062	3	779023.2	1150964.2	0.0	0.0	0.0	5993703.0
26835	4	716231.8	5651924.3	0.0	0.0	0.0	8299813.8
27631	1	1467466.5	1467466.5	0.0	0.0	0.0	1467466.5
28451	1	6404317.2	6404317.2	0.0	0.0	0.0	6404317.2
29295	2	2884040.2	2909788.0	0.0	0.0	0.0	2909788.0
32929	1	6344821.7	6344821.7	0.0	0.0	0.0	6344821.7
34911	1	8860805.9	8860805.9	0.0	0.0	0.0	8860805.9
37013	1	1917479.3	1917479.3	0.0	0.0	0.0	1917479.3
42838	1	2772594.7	2772594.7	0.0	0.0	0.0	2772594.7
45418	1	4118270.1	4118270.1	0.0	0.0	0.0	4118270.1
59086	1	4070054.5	4070054.5	0.0	0.0	0.0	4070054.5

\*\*\*\* client1.homa2.log:

1525290400.731111158 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.004, expecting 0.100, throttled 0.092

\*\*\*\* client3.homa4.log:

1525290400.560646350 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.007, expecting 0.100, throttled 0.088

\*\*\*\* client2.homa3.log:

1525290400.548116193 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.007, expecting 0.100, throttled 0.088

## Homa+Udp : W2 load





```
homa@homa1:~/platformlab/RAMCloud$ scripts/clusterperf.py --transport homa+udp -r 0
--clients 3 --servers 1 --messageSizeCDF benchmarks/homa/messageSizeCDFs/W2.txt
--targetTput 1.0 echo_workload
```

```
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa1,10.145.94.33' (ECDSA) to the list of known hosts.
```

```
# Generated by 'clusterperf.py echoWorkload'
```

```
#
```

#	Size	Samples	Min	Median	90%	99%	99.9%	Max
#-----								
2	87008	117.5	4106549.6	7374025.4	8735323.1	9289452.2	9323595.8	
3	65347	97.7	4108177.5	7378061.5	8739221.8	9286459.0	9323601.7	
4	21805	123.9	4084926.7	7351568.4	8729393.9	9279580.7	9323425.8	
8	21751	133.1	4071623.5	7394498.9	8787361.5	9289921.3	9323854.9	
32	21883	127.4	4105828.7	7366558.1	8749842.1	9283554.4	9322561.8	
34	16074	112.1	4113451.9	7385909.7	8768860.4	9286684.2	9321647.1	
36	15845	135.0	4133552.7	7381856.3	8747566.8	9277161.6	9322290.6	
38	15814	118.0	4151561.6	7381085.6	8826610.7	9301498.3	9321235.9	
40	15610	116.3	4137334.8	7387031.0	8774252.3	9307863.9	9323846.6	
43	15621	135.8	4097398.1	7375955.6	8783762.3	9295139.4	9324775.6	
46	15734	156.8	4094968.4	7372044.5	8707655.4	9281563.2	9324770.2	
49	15708	139.9	4131189.6	7384286.1	8669558.3	9271431.7	9321642.6	
53	15594	119.4	4087813.6	7374028.1	8763077.7	9277161.1	9322996.0	
58	15700	120.4	4138167.6	7408547.1	8805141.4	9283562.6	9319452.9	
64	15879	148.6	4096333.7	7369082.1	8780417.6	9300062.9	9323004.2	
67	1723	176.5	4238390.4	7421774.2	8809823.2	9259070.1	9305469.6	
71	1751	136.3	4184955.8	7346065.8	8863512.6	9313376.6	9314928.6	
75	1777	759.6	4076119.2	7280531.9	8591428.7	9192565.3	9239017.0	
80	1843	155.5	4110183.4	7326265.3	8383154.1	9311023.1	9317613.3	
85	1738	187.5	4061201.5	7362155.9	8702287.1	9226843.7	9309979.8	
91	1737	168.7	4274465.5	7473019.4	8809639.2	9318346.6	9320576.0	

98	1834	146.3	4113452.4	7386305.3	8584564.9	9228101.9	9248931.2
107	1730	7682.5	4085111.3	7346478.0	8654744.0	9289929.1	9307315.4
116	1841	143.5	4094763.0	7359450.5	8539208.4	9286470.3	9315794.7
128	1778	133.8	4092257.7	7374020.0	8587048.8	9132569.7	9164037.9
135	14210	115.8	4108520.4	7370660.9	8740582.0	9284411.4	9323425.4
142	14109	112.7	4121847.2	7438279.8	8886692.8	9296746.0	9323000.5
151	14165	131.6	4076150.5	7355023.2	8723416.3	9274411.8	9322288.0
160	14203	107.5	4120494.4	7417593.4	8791493.3	9286889.5	9318838.6
171	14160	117.6	4085041.0	7404594.8	8862382.7	9287519.3	9322292.2
183	13900	113.6	4074871.9	7378708.4	8677345.1	9249856.7	9323422.7
197	14073	130.8	4077712.3	7364944.5	8806150.0	9286310.1	9323006.3
213	14056	131.8	4158966.2	7420233.3	8766020.8	9276718.0	9320988.7
233	14125	116.8	4105780.6	7331879.4	8609314.6	9273873.9	9318833.2
256	13938	194.6	4091811.0	7353344.1	8634905.2	9263846.3	9317607.4
269	51673	120.1	4123804.9	7370341.0	8819353.1	9284232.7	9322740.9
284	51582	111.3	4102211.5	7380990.5	8741590.1	9285301.4	9324012.5
301	51903	119.5	4124594.8	7385787.6	8736835.7	9291367.6	9323860.8
320	51447	123.5	4137654.1	7383092.8	8737884.1	9279332.3	9324778.2
341	51723	121.2	4096221.5	7380911.5	8797630.7	9285073.6	9323849.4
366	51414	123.0	4105145.1	7352780.0	8747558.5	9287100.3	9324772.9
394	51762	108.0	4096491.3	7372181.8	8747155.3	9292017.0	9324778.4
427	51741	115.3	4113829.8	7382415.0	8788747.2	9292924.3	9324045.3
465	51419	108.6	4106667.0	7383748.0	8784492.1	9296916.2	9324290.2
512	51484	118.7	4092574.7	7389375.7	8753914.3	9279594.6	9323865.4
539	5524	136.8	4162887.8	7390935.9	8671182.2	9257731.2	9319007.2
569	5497	139.2	4078991.5	7374786.4	8683717.3	9296228.5	9321364.8
602	5491	141.3	4088464.2	7408711.6	8825645.2	9271664.0	9315095.5
640	5587	128.9	4051044.4	7409736.8	8793821.0	9260984.5	9323416.9
683	5596	195.4	4104642.3	7405335.4	8949395.9	9283350.3	9318021.9
731	5482	160.4	4163971.7	7449397.2	8820092.4	9312806.8	9320575.8
788	5576	127.1	4104572.2	7388760.9	8720357.3	9298718.9	9323433.2
853	5569	161.9	4077397.3	7366472.1	8749364.2	9268451.2	9312801.6
931	5512	120.3	4167688.9	7384444.9	8806601.9	9278446.5	9323154.2
1024	5584	162.2	4034738.8	7383336.0	8723668.5	9289931.0	9322547.7
1078	2672	155.1	4223581.0	7376587.7	8884584.2	9287110.9	9321645.9
1138	2655	193.4	4035177.1	7352551.3	8573972.9	9317314.8	9323603.8
1205	2617	180.1	4151604.1	7219806.8	8598547.6	9254955.1	9303749.8
1280	2669	175.9	4133316.5	7357316.4	8829335.0	9261836.9	9294924.0
1365	2691	157.2	4092630.4	7335159.7	8833899.4	9255632.2	9324047.1
1463	2555	190.9	4153421.7	7335886.0	8684993.0	9232343.7	9283969.8
1575	2635	170.7	4033532.5	7358361.7	8640645.6	9293314.6	9320120.9
1707	2609	163.3	4181050.2	7357590.5	8556836.8	9305629.5	9324289.6
1862	2729	185.8	4022981.7	7429039.5	8892150.6	9297855.8	9322287.0

2048	2629	209.4	4110929.7	7419301.1	8784027.0	9299640.7	9319734.2
2156	1602	221.4	4136568.5	7463653.5	8816612.3	9193449.0	9221633.2
2276	1576	1357.6	4107035.2	7320407.5	8579028.3	9305021.3	9315549.8
2409	1606	199.1	4308705.7	7462045.7	8877999.3	9278448.0	9307796.9
2560	1635	5214.7	4169922.7	7385658.3	8544963.8	9301985.1	9319462.9
2731	1668	242.2	4096069.3	7359300.8	8674085.4	9301092.6	9303453.1
2926	1600	388.5	4007189.8	7316706.4	8868680.9	9289647.6	9322088.2
3151	1659	647.7	4176101.8	7456094.7	8793522.5	9291576.9	9308590.9
3413	1620	6084.4	4167683.4	7356861.4	8429258.9	9154607.3	9197871.9
3724	1626	221.6	4167412.7	7425435.6	8561799.9	9220133.2	9297857.7
4096	1632	7437.0	4079404.2	7333292.7	8487591.0	9293793.9	9324776.8
4312	383	4536.6	3955209.2	7384289.1	8749362.6	0.0	9252682.0
4551	365	402.1	4672654.7	7558058.2	8485957.1	0.0	9008905.6
4819	382	4183.3	4184915.0	7269640.4	8421569.8	0.0	9176159.7
5120	362	44955.7	3951525.1	7463320.6	8850161.7	0.0	9281130.2
5461	347	17529.8	3989099.3	7344420.0	8141849.8	0.0	9216370.7
5851	368	42546.0	4009536.7	7270646.8	8727169.5	0.0	9312515.4
6302	359	11921.8	3867077.5	7368342.1	8478953.1	0.0	9289013.6
6827	353	11700.0	4324985.3	7331323.8	9088450.6	0.0	9296769.4
7447	361	3243.6	3741690.3	7424108.6	8001734.1	0.0	9189716.2
8192	342	2363.4	4144595.5	7337775.8	8276165.0	0.0	9316746.4
8623	64	321585.1	4052026.8	6854450.3	0.0	0.0	7845348.9
9102	51	357805.9	4198747.9	7754051.0	0.0	0.0	8125247.6
9638	51	699511.2	5015823.2	7623549.3	0.0	0.0	8964887.5
10240	48	58028.8	3012528.6	6589519.2	0.0	0.0	9307038.5
10923	47	49073.9	3810518.4	7176341.5	0.0	0.0	7746172.6
11703	44	506421.6	4978449.3	7809509.4	0.0	0.0	8516916.3
12603	45	316704.3	4238706.3	7140956.2	0.0	0.0	8130152.2
13653	48	68480.5	3782958.9	7463549.5	0.0	0.0	8167471.8
14895	72	94925.0	4472751.1	7320508.3	0.0	0.0	8747386.6
16384	56	136051.4	3866999.2	7398495.0	0.0	0.0	8875261.7
17246	27	13089.6	4073280.6	7901360.0	0.0	0.0	8601002.0
18204	25	159775.6	5356926.7	7611014.4	0.0	0.0	7991151.3
19275	28	193054.2	2959282.9	7547007.8	0.0	0.0	9204740.8
20480	21	564821.6	3110313.5	6829853.8	0.0	0.0	9273662.1
21845	21	60344.3	3406146.7	7166184.7	0.0	0.0	7929379.4
23406	25	43909.5	4032747.6	7380872.4	0.0	0.0	7979575.8
25206	22	422285.3	4043797.9	7422707.4	0.0	0.0	9168029.4
27307	20	61151.0	4779596.1	7653682.0	0.0	0.0	7948625.8
29789	24	223909.7	3433982.3	6803355.7	0.0	0.0	8009215.7
32768	24	144573.9	3814280.5	7344276.8	0.0	0.0	8644590.9
34493	24	242251.7	3473180.7	7634226.1	0.0	0.0	8860015.0
36409	17	153817.9	4220960.4	7554148.0	0.0	0.0	7909402.9

38551	28	392203.1	6018612.1	7972599.2	0.0	0.0	8432159.0
40960	21	172033.2	3486372.6	7614621.6	0.0	0.0	7818082.7
43691	21	287213.8	4043617.2	6328529.4	0.0	0.0	7154248.3
46811	22	537680.7	3984868.5	6821826.3	0.0	0.0	7149602.4
50412	29	110144.4	4646350.9	7598733.8	0.0	0.0	8119733.8
54613	28	968786.2	5670271.4	7252227.5	0.0	0.0	9170881.4
59578	19	20860.8	4005817.3	7399347.2	0.0	0.0	7780117.5
65536	31	43442.7	4869493.5	7407909.2	0.0	0.0	8194821.1
68985	57	3182.8	3343826.9	6627051.0	0.0	0.0	8416845.8
72818	38	34443.6	3462825.5	7259397.8	0.0	0.0	7973910.6
77101	55	89818.4	3660183.8	6999173.1	0.0	0.0	8078702.4
81920	61	68129.2	4262429.6	6844269.2	0.0	0.0	8597284.8
87381	67	95504.2	4459690.0	7195972.2	0.0	0.0	8545199.9
93623	47	62384.3	4835007.3	7881159.0	0.0	0.0	9192275.6
100825	71	184845.6	3950594.4	6867638.3	0.0	0.0	7753733.3
109227	76	194045.9	4405195.0	7630012.5	0.0	0.0	9105301.0
119156	66	278206.2	4743442.5	7243473.1	0.0	0.0	8676390.2
131072	67	259343.6	5040060.8	7214996.0	0.0	0.0	7982711.0
137971	7	1264688.6	5447473.3	0.0	0.0	0.0	8930540.4
145636	15	1050366.3	2974875.4	7184694.6	0.0	0.0	7322508.1
154202	7	2066618.9	3441010.5	0.0	0.0	0.0	7975384.1
163840	13	336122.0	3417478.1	5494587.3	0.0	0.0	6583900.8
174763	15	1659456.7	5465537.2	7699066.5	0.0	0.0	7986307.9
187246	18	53506.9	4521931.2	7103787.6	0.0	0.0	7803067.5
201649	10	299333.4	1487049.4	4951181.4	0.0	0.0	4951181.4
218453	8	1204637.2	5444917.3	0.0	0.0	0.0	6926149.3
238313	14	671425.1	4349562.6	6007785.7	0.0	0.0	6469232.0
262144	16	1077319.1	4078316.8	8593050.7	0.0	0.0	9089473.9
275941	1	7074570.9	7074570.9	0.0	0.0	0.0	7074570.9
308405	2	2130480.6	7873194.3	0.0	0.0	0.0	7873194.3
327680	1	6973789.2	6973789.2	0.0	0.0	0.0	6973789.2
349525	1	2388630.8	2388630.8	0.0	0.0	0.0	2388630.8
374491	2	2821500.7	6081730.2	0.0	0.0	0.0	6081730.2
436907	3	543492.3	6733875.5	0.0	0.0	0.0	6804695.8
573085	3	3145289.8	4702453.0	0.0	0.0	0.0	6053273.5
631896	4	1901759.6	7425637.6	0.0	0.0	0.0	9015102.4
704160	4	3334017.2	7963580.4	0.0	0.0	0.0	8073830.3
795085	1	1653412.2	1653412.2	0.0	0.0	0.0	1653412.2
912974	1	3287404.0	3287404.0	0.0	0.0	0.0	3287404.0
1071908	1	7880782.5	7880782.5	0.0	0.0	0.0	7880782.5
1297841	2	747536.3	1666729.9	0.0	0.0	0.0	1666729.9
1644453	1	2506133.2	2506133.2	0.0	0.0	0.0	2506133.2

\*\*\*\* client1.homa2.log:

1525290802.415216233 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.007, expecting 0.100, throttled 0.088

\*\*\*\* server1.homa1.log:

1525290792.855428746 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 7107: timeout

1525290792.900160096 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 7987: timeout

1525290793.219698102 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 13022: timeout

1525290793.409100756 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 15996: timeout

1525290793.529223638 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 18030: timeout

1525290793.785987685 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 22398: timeout

1525290793.849078189 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 23383: timeout

1525290794.961345870 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 45228: timeout

1525290795.191761107 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 49529: timeout

1525290795.572181416 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 56639: timeout

1525290795.916793681 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 62947: timeout

1525290795.925010477 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 63068: timeout

1525290796.532095043 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 74592: timeout

1525290796.637981504 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 76370: timeout

1525290797.185686673 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 86280: timeout

1525290797.271313332 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 87696: timeout

1525290797.448108598 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 91034: timeout

1525290797.572004570 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 93126: timeout

1525290797.627119616 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 94134: timeout

1525290798.024545480 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 100206: timeout

1525290798.819062348 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 114280: timeout

1525290798.880073828 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 115280: timeout

1525290799.373148642 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 124494: timeout

1525290799.601574250 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 129259: timeout

1525290799.670909579 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 130385: timeout

1525290799.807462992 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 132757: timeout

1525290800.714012959 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 149502: timeout

1525290801.078874991 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 156913: timeout

1525290801.528621240 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting ECHO RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 165018: timeout

1525290801.551084085 HomaTransport.cc:2187 in checkTimeouts WARNING[1]: aborting null RPC from client 10.145.94.43:38122, clientId 14858121603775239252, sequence 165415: timeout

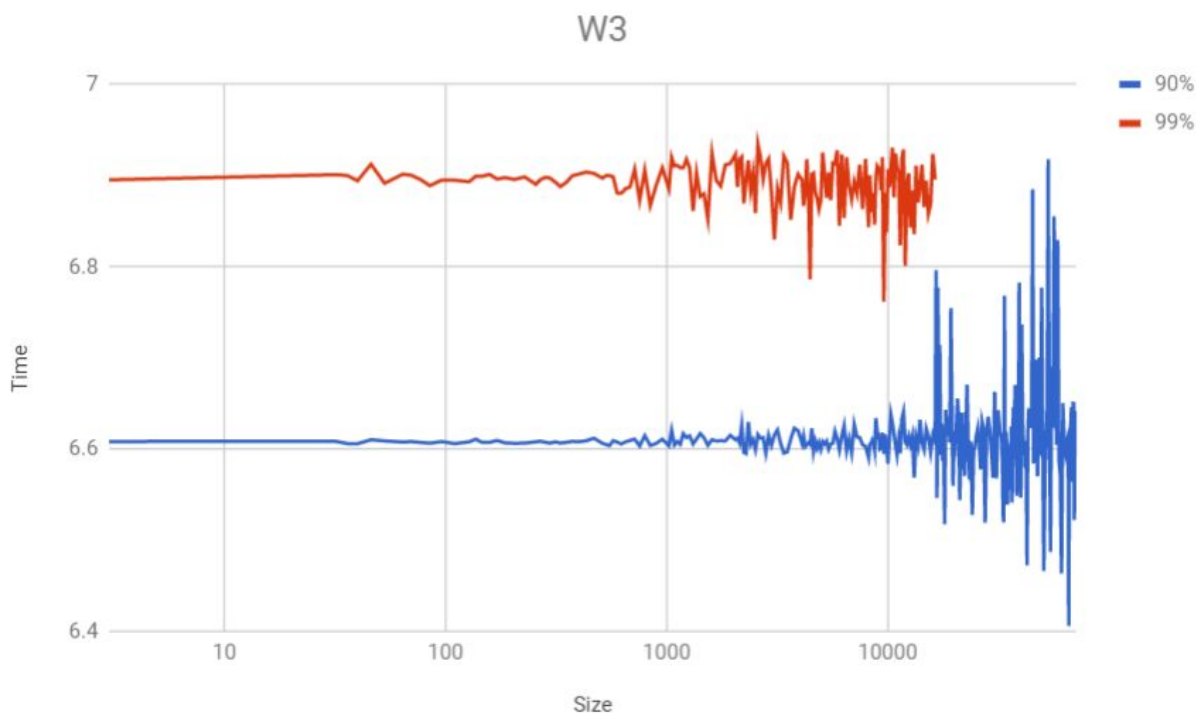
\*\*\*\* client3.homa4.log:

1525290802.309966908 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.017, expecting 0.100, throttled 0.069

\*\*\*\* client2.homa3.log:

1525290802.319583425 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.017, expecting 0.100, throttled 0.069

## Homa+Udp : W3 load



```
homa@homa1:~/platformlab/RAMCloud$ scripts/clusterperf.py --transport homa+udp -r 0
--clients 3 --servers 1 --messageSizeCDF benchmarks/homa/messageSizeCDFs/W3.txt
--targetTput 1.0 echo_workload
```

```
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa1,10.145.94.33' (ECDSA) to the list of known hosts.
```

```
# Generated by 'clusterperf.py echoWorkload'
```

```
#
```

#	Size	Samples	Min	Median	90%	99%	99.9%	Max
3	28817	233.7	1952216.2	4057381.0	7858213.7	8673713.6	8768237.0	
32	14218	231.3	1935181.2	4057730.5	7961233.5	8673587.3	8768387.0	
36	5061	356.2	1893285.8	4035373.5	7943608.7	8602992.8	8731740.3	
40	5113	358.2	1918561.8	4034019.5	7838925.2	8702663.1	8765030.9	
46	5122	278.5	1945538.1	4074983.3	8174562.3	8722814.1	8767328.4	
53	5127	194.1	1946959.1	4062800.0	7789909.1	8645727.0	8727353.3	
64	5160	200.8	1906789.6	4051457.4	7970139.8	8716130.7	8763516.5	
70	14610	220.9	1960055.0	4055716.5	7949762.0	8679466.2	8767418.2	
77	14356	237.2	1936385.8	4047161.1	7864220.2	8675319.5	8768258.6	
85	14570	228.5	1945739.0	4039551.1	7741893.1	8714024.1	8768386.7	
96	14422	191.9	1918664.0	4055965.3	7854234.5	8667435.1	8763670.8	
110	14396	334.2	1939308.8	4034835.8	7851250.4	8639797.4	8759367.2	
128	14449	218.7	1943187.8	4053494.4	7821664.4	8624797.7	8768246.5	
137	8080	201.2	1920170.6	4081045.2	7929538.2	8695598.7	8761833.2	
146	8149	322.5	1907215.9	4047896.5	7928009.9	8701752.8	8767351.1	
158	8101	317.9	1922977.4	4047389.5	7967122.0	8672646.5	8761811.0	
171	8037	318.4	2000987.1	4067841.8	7873212.7	8702684.8	8770619.1	
186	8126	221.4	1929374.9	4042574.0	7902711.6	8636162.8	8753519.8	
205	8177	180.9	1945502.0	4038328.0	7865448.6	8711009.5	8767245.2	
228	8074	235.7	1954738.2	4040416.2	7915928.4	8657871.9	8740569.9	
256	8224	263.2	1980710.9	4053259.5	7770342.3	8648549.4	8767395.7	
268	11385	248.4	1909451.5	4059807.2	7858258.6	8667034.4	8749173.7	
282	11646	202.3	1929793.6	4049212.7	7905971.5	8702464.0	8756342.2	



296	11640	210.9	1911675.9	4040172.0	7896705.6	8667011.8	8752226.5
313	11583	202.4	1971625.3	4052825.7	7814334.9	8626702.9	8767228.6
331	11522	236.3	1979123.2	4041338.1	7725264.8	8723880.4	8769413.8
352	11641	254.2	1937949.8	4047900.8	7810393.7	8670861.2	8767222.2
375	11568	272.2	1924086.6	4057979.2	7941843.3	8637925.9	8763319.2
402	11657	197.7	1962502.1	4054624.5	7975005.7	8702640.6	8770840.3
433	11708	351.5	1925857.6	4064381.9	8012726.0	8720261.2	8771772.0
469	11441	227.8	1962565.4	4090403.9	7986459.9	8628593.5	8754372.5
512	11573	262.1	1919228.0	4038779.7	7892766.3	8712802.1	8763693.4
531	2536	344.8	1901629.1	4027363.0	7940912.5	8669750.3	8749152.1
551	2481	425.1	1946365.1	4014976.7	7942684.3	8719222.9	8750916.9
573	2520	384.1	1863227.2	4065354.1	7917128.5	8574760.8	8754597.3
597	2560	278.0	1897927.2	4051579.8	7600004.8	8577940.3	8675436.2
623	2477	258.7	1929740.2	4031812.9	7596875.5	8678864.9	8760112.7
652	2603	396.9	1978864.9	4053319.8	7685191.7	8628396.6	8767264.9
683	2479	385.1	2002344.0	4067933.1	7719970.0	8604205.7	8760490.3
717	2417	285.6	1877984.3	4080831.5	8071064.6	8642961.5	8692689.1
755	2466	347.4	1964119.4	4011260.5	7461812.0	8643358.2	8725601.8
796	2474	361.2	1957586.5	4118367.1	8051357.7	8679564.8	8752294.1
843	2500	432.3	1973077.3	4016761.9	7361618.6	8673566.2	8709889.6
896	2599	282.9	1974276.3	4036496.2	7745677.4	8718976.2	8763496.1
956	2459	401.3	2056812.1	4080995.7	8100220.6	8753189.6	8771059.4
1024	2497	215.6	1791074.9	4014271.6	7681543.2	8661652.2	8695643.8
1053	1120	241.2	2073285.8	4174937.0	8316400.1	8653580.2	8759423.7
1084	1147	402.4	1809047.9	4021055.9	8137798.6	8670882.7	8724385.1
1117	1176	457.4	1967876.5	4056871.6	8150842.5	8682361.9	8706623.8
1152	1154	406.8	1891622.2	4027839.2	8101281.0	8745529.1	8758088.3
1189	1140	220.6	2018639.4	4138662.5	8103009.3	8704810.8	8756563.2
1229	1145	415.5	1870114.1	4097561.0	8275881.5	8643540.4	8756541.4
1271	1049	479.5	1934993.5	4115314.8	8098955.3	8552038.4	8632014.3
1317	1121	451.4	1823480.8	4032267.4	7266571.4	8504397.7	8615451.4
1365	1113	392.6	2006840.0	4082659.9	7998608.3	8532790.9	8632121.8
1418	1085	291.9	2027997.4	4139438.8	7534382.9	8398221.2	8500227.3
1475	1033	531.0	1895535.4	4097210.1	7584940.6	8511809.1	8556818.3
1536	1155	431.5	1842558.0	4017476.6	7117971.4	8286426.1	8348392.7
1603	1096	412.5	1940206.5	4076466.2	8404838.6	8748978.8	8755953.5
1676	1132	222.9	1929286.5	4061995.5	7848553.9	8706438.2	8731670.6
1755	1218	439.9	1962892.5	4065463.5	7735192.0	8462628.7	8587188.6
1843	1139	530.2	2010489.0	4063266.0	8159823.1	8768390.5	8769198.4
1940	1139	351.1	2000282.0	4121281.2	8189319.5	8718996.8	8760275.0
2048	1086	361.0	2013724.5	4075567.3	8381784.6	8723923.9	8726458.4
2092	497	588.7	1680843.1	4090711.4	7712534.7	0.0	8536052.5
2137	472	533.1	1920197.8	4042796.8	8275655.9	0.0	8720313.1

2185	466	458.8	2039557.4	4224666.6	8326143.6	0.0	8636228.7
2234	491	529.0	1894078.4	3947059.4	7402820.4	0.0	8564488.7
2286	489	472.9	1974391.4	3936554.1	7837117.4	0.0	8624694.8
2341	483	568.2	1876764.6	4261696.7	8251632.6	0.0	8769218.0
2398	488	586.9	2082491.7	4030186.6	7664620.9	0.0	8760942.6
2458	497	671.0	2048001.0	4075378.9	7990156.0	0.0	8672667.7
2521	492	413.8	1916077.1	3974055.0	7229296.1	0.0	8454633.8
2587	451	436.8	1766505.1	4128307.0	8596198.6	0.0	8722610.2
2657	487	507.1	1974060.8	4091510.6	8326975.2	0.0	8507508.2
2731	500	538.9	2034161.0	4096514.2	7869661.8	0.0	8603014.0
2809	473	494.5	1936745.7	3940088.6	8188199.7	0.0	8529846.2
2891	484	463.0	1811280.2	4120654.4	8286001.6	0.0	8716396.0
2979	488	460.1	1999144.0	4016172.3	7615100.5	0.0	8369058.9
3072	499	650.2	1977891.4	4124673.1	6758411.4	0.0	7814701.7
3171	492	348.4	2107540.3	4177141.3	7683022.8	0.0	8514071.9
3277	479	298.6	2074159.9	4037583.4	7418420.9	0.0	8707047.1
3390	496	593.3	1858172.6	3939582.2	8346018.8	0.0	8653835.4
3511	465	512.6	1993992.0	3951771.7	8203905.5	0.0	8738013.5
3641	462	702.0	2045710.6	4081457.9	7103384.4	0.0	8487183.3
3781	495	618.6	1872331.1	4195840.6	7721621.4	0.0	8612251.7
3932	513	388.0	2025867.5	4170229.9	7971851.2	0.0	8588175.8
4096	458	290.7	2018262.9	4037635.2	7852086.8	0.0	8564698.8
4163	393	497.6	1950430.4	4115910.8	7359425.9	0.0	8764130.2
4233	411	572.2	1931633.8	4004886.6	7575488.7	0.0	8341616.1
4304	388	517.3	1924144.2	4022989.4	8279075.4	0.0	8598836.2
4378	393	573.8	2014781.4	4045008.3	7652204.1	0.0	8464433.4
4455	430	563.9	1939243.1	4027569.6	6113372.5	0.0	8688190.2
4535	438	415.8	1973797.0	4194573.1	7964522.9	0.0	8639704.4
4617	420	608.3	1905305.9	3958588.1	7992725.1	0.0	8727618.7
4703	450	598.9	2047218.2	4057726.8	7612238.8	0.0	8614486.7
4792	409	559.2	1784765.3	3988573.4	7501338.5	0.0	8345628.0
4884	374	502.0	1943154.8	4045010.7	7299747.0	0.0	8418335.9
4979	437	462.2	1611099.5	3975527.0	7454367.4	0.0	8680922.8
5079	390	579.8	1794718.5	4056279.7	8418780.7	0.0	8755253.9
5183	393	463.0	1855820.6	4031413.8	7957611.8	0.0	8567460.5
5291	431	500.9	2090221.0	4060952.0	7509255.2	0.0	8281343.7
5403	433	641.0	1692652.9	3979200.1	8007693.9	0.0	8495625.5
5521	393	677.4	2203320.7	4030685.7	7464531.9	0.0	8200388.8
5643	441	531.1	1737262.5	4039188.5	8197375.2	0.0	8641827.2
5772	427	524.0	2055719.3	4162049.2	8182926.3	0.0	8761663.3
5906	459	480.4	2243418.8	4089274.9	8466088.7	0.0	8685076.4
6046	424	560.8	1774375.1	3971471.4	6997283.3	0.0	8671318.6
6194	366	514.7	1992776.5	4109187.4	8379934.8	0.0	8766323.3

6349	424	611.5	1956131.8	4220764.3	7136667.3	0.0	8491822.4
6512	447	563.3	1908177.0	3963793.9	8320056.5	0.0	8620059.8
6683	389	564.1	1941216.3	4082373.6	7750132.0	0.0	8315932.0
6864	437	559.1	1884675.6	3942610.6	7479382.2	0.0	8765703.8
7054	480	589.2	1957164.1	4234950.4	7820862.5	0.0	8624046.9
7256	406	881.3	1922622.7	4104407.2	7602175.9	0.0	8735191.5
7469	397	528.9	2004775.7	4098122.2	8168158.0	0.0	8757864.4
7696	404	570.0	2026701.3	4024718.3	7301030.9	0.0	8730112.7
7936	464	706.2	1887216.0	4006830.8	8285351.3	0.0	8769977.5
8192	411	616.3	1773528.8	3894839.7	6970877.6	0.0	8663962.0
8293	242	756.6	2125237.9	4026032.7	7949102.3	0.0	8558381.3
8397	187	679.2	2063971.4	4034944.0	7517548.3	0.0	7763614.8
8503	234	520.9	2249386.0	4069475.7	7238491.1	0.0	8399891.3
8612	227	850.9	1848379.6	4036946.0	7610142.4	0.0	8150022.0
8724	207	673.3	1972851.8	3962886.0	7016886.8	0.0	7876583.8
8839	255	665.9	2078012.9	4305749.9	7907720.4	0.0	8375632.9
8957	225	538.4	2449835.1	4156458.5	8134897.8	0.0	8663249.9
9078	212	767.2	1971848.6	4133504.5	8088518.7	0.0	8569532.0
9202	247	961.2	1854284.9	3980029.9	8074258.3	0.0	8255947.4
9330	245	885.3	1885007.6	3989041.3	7650869.6	0.0	8437679.0
9461	228	768.9	2002041.4	4148649.1	8323351.7	0.0	8708486.3
9596	231	741.1	2202084.3	3930317.7	5778434.3	0.0	7995727.7
9735	218	743.8	1881537.9	4130836.3	7606140.8	0.0	8337786.0
9879	198	872.0	2098689.5	4008810.2	6885795.3	0.0	7234328.8
10026	236	677.4	1930021.8	3835289.4	8072755.6	0.0	8684610.9
10178	216	592.4	2074598.1	4090617.1	7709280.4	0.0	8202548.2
10335	203	740.1	2149766.1	4340220.2	8092532.8	0.0	8678379.2
10496	232	710.5	2023881.7	4253360.1	8521260.3	0.0	8690486.0
10663	233	746.6	2105918.7	4140578.1	7515808.7	0.0	8033988.9
10835	220	654.6	1737410.5	4020588.5	8401843.6	0.0	8721743.0
11012	226	1473.5	1944236.3	3923039.8	8128392.3	0.0	8307143.7
11196	223	1492.7	1909108.7	4072497.8	8009421.5	0.0	8361552.4
11385	211	1671.8	2069135.8	3940190.2	6659208.1	0.0	7831401.8
11582	224	1912.6	1877316.9	4294836.5	8294024.7	0.0	8607315.4
11785	226	1514.6	2003446.0	4371507.2	8482875.1	0.0	8747896.6
11995	222	1572.0	1900794.3	4054714.1	6322767.7	0.0	8131519.0
12214	220	1550.4	1532872.7	4022994.2	7754047.3	0.0	8398540.2
12440	223	1768.3	1892657.9	4109612.5	7987811.2	0.0	8436049.9
12674	219	1641.3	2075801.5	4027443.9	6967113.1	0.0	8670020.4
12918	219	1497.2	1986791.1	4112421.8	7650178.6	0.0	8420185.7
13171	203	1635.8	1876494.3	3700918.2	6848280.0	0.0	7814029.1
13435	210	1697.0	1854050.5	4097462.0	8147328.7	0.0	8716819.7
13709	226	1574.2	1941575.8	4012484.1	7418029.4	0.0	7645463.8

13995	216	1581.7	2223271.4	4283803.1	7713716.8	0.0	8349464.0
14292	222	1553.6	2042877.0	4043609.4	8167869.0	0.0	8454650.2
14603	209	1790.0	1826901.9	3973544.2	7330263.5	0.0	8212332.5
14928	186	2270.4	2054747.4	4191115.5	7844573.5	0.0	8011481.8
15267	204	1504.6	1839005.1	4113575.6	7211349.0	0.0	8064013.2
15622	239	1610.1	2038396.3	3948918.9	7381915.1	0.0	8647668.7
15994	197	1719.3	2276446.0	4126120.3	8387496.6	0.0	8546550.4
16384	206	1721.0	1943488.1	4053346.5	7862754.1	0.0	8674728.6
16540	49	2365.7	2995823.2	6253912.8	0.0	0.0	8611241.8
16699	38	2208.9	1096046.9	3518940.8	0.0	0.0	4354705.6
16861	52	2202.8	1846208.1	5987682.2	0.0	0.0	8383330.9
17027	45	2148.8	1971040.7	4171321.0	0.0	0.0	8553761.3
17195	47	2949.6	2256419.3	5179598.0	0.0	0.0	8094512.0
17367	41	2595.9	2184001.0	3921128.8	0.0	0.0	7544259.7
17542	54	1825.5	2046111.1	4245457.0	0.0	0.0	8498372.6
17721	44	2305.7	2034883.9	3862868.0	0.0	0.0	4486832.8
17904	48	1852.6	1446317.6	3921408.2	0.0	0.0	7441924.5
18091	51	2825.1	1913306.2	3292116.5	0.0	0.0	4550375.2
18281	45	2767.8	1908998.5	4396782.5	0.0	0.0	6430520.3
18476	56	2215.0	2120904.0	4115547.2	0.0	0.0	7769889.6
18674	62	1671.0	2323639.6	4274615.0	0.0	0.0	8703719.8
18877	36	2211.6	2059562.9	4248181.8	0.0	0.0	5614755.8
19085	55	2194.4	2315855.8	4046293.5	0.0	0.0	8524245.3
19297	44	2536.1	2323181.6	5685921.9	0.0	0.0	8713268.0
19514	58	2439.0	1474866.0	4401652.5	0.0	0.0	6530287.5
19735	41	2447.4	2088994.2	3628135.1	0.0	0.0	6601527.5
19962	43	2642.3	1864016.0	4023970.6	0.0	0.0	8366047.1
20194	44	2380.1	1988252.1	3990373.2	0.0	0.0	6997249.6
20432	41	2636.2	1912493.7	4213104.1	0.0	0.0	5752946.6
20675	40	1723.3	1899919.0	4521329.6	0.0	0.0	6962997.4
20924	40	1989.5	1652471.7	4316529.1	0.0	0.0	8558330.0
21179	51	2422.3	1397004.5	3499559.2	0.0	0.0	8447724.3
21441	52	2789.7	2190170.6	4075890.2	0.0	0.0	7937118.8
21709	40	2038.5	1302474.1	4362784.7	0.0	0.0	7966013.8
21984	46	3763.5	2261174.4	3950910.8	0.0	0.0	5882491.0
22265	51	3977.8	1597830.5	3719136.2	0.0	0.0	6048430.5
22555	43	5260.0	2055576.3	4139744.1	0.0	0.0	7078768.5
22851	40	3351.2	1783004.3	4682013.4	0.0	0.0	8335055.1
23156	51	2656.3	1934046.3	3980714.5	0.0	0.0	8606722.0
23469	49	2720.1	1623065.3	3681625.7	0.0	0.0	7874362.8
23790	43	4684.6	2241865.9	4058019.0	0.0	0.0	7917085.3
24121	52	2596.9	2040158.2	3370025.1	0.0	0.0	6473430.6
24461	58	3157.7	1440112.4	3952357.0	0.0	0.0	7903877.1

24810	48	3224.3	2260183.8	4006622.5	0.0	0.0	7763981.1
25170	62	2894.2	2324925.7	4119128.2	0.0	0.0	8753216.6
25540	51	4020.4	2017509.0	4193885.8	0.0	0.0	7695689.7
25921	36	351206.2	2002262.3	4039991.6	0.0	0.0	8237639.8
26314	51	3082.2	2532396.7	3781145.9	0.0	0.0	8635674.6
26719	37	4235.6	2079376.9	4264675.9	0.0	0.0	7606594.2
27136	58	3341.6	2086723.5	4187553.5	0.0	0.0	8025407.5
27567	50	4190.9	2015959.7	3304363.1	0.0	0.0	3915337.8
28011	49	3565.4	2278658.7	4150413.9	0.0	0.0	7509001.1
28471	37	4738.3	2207669.5	4321809.1	0.0	0.0	4520662.0
28945	46	2929.3	2296070.1	4151916.5	0.0	0.0	6806935.5
29436	44	2903.4	1988598.6	3961555.6	0.0	0.0	7300031.8
29943	52	3479.3	1305613.1	3700748.9	0.0	0.0	7453183.1
30468	49	3694.0	2138373.4	4599784.8	0.0	0.0	8277572.1
31013	41	4030.8	1468807.4	3693935.5	0.0	0.0	5437307.3
31576	40	3417.7	2377114.9	4391640.2	0.0	0.0	5620834.4
32161	49	4865.7	1901333.8	4151119.4	0.0	0.0	7676477.2
32768	54	3149.3	1166626.7	4094786.4	0.0	0.0	7419517.7
33007	11	636246.9	2095894.3	3831166.8	0.0	0.0	5433389.7
33250	20	2190.3	1407795.4	3374334.8	0.0	0.0	7647201.4
33496	11	3707.5	57599.3	3307238.4	0.0	0.0	3846129.2
33746	15	284716.5	3461902.0	5863649.7	0.0	0.0	6753982.3
34000	24	5465.6	1939242.8	3485991.3	0.0	0.0	4452772.0
34257	14	36860.8	1439893.2	4160164.1	0.0	0.0	5961208.0
34519	20	6982.9	2078832.0	4031744.0	0.0	0.0	4104074.2
34784	12	28116.8	2050737.4	3458380.0	0.0	0.0	4124746.2
35054	23	4599.9	1969958.6	3699642.2	0.0	0.0	5102636.0
35328	10	47566.3	1898007.7	3967736.3	0.0	0.0	3967736.3
35606	27	15918.2	2287054.2	3946543.7	0.0	0.0	4378061.8
35889	15	38986.3	2478773.6	3588895.1	0.0	0.0	4330854.9
36176	26	4764.7	1931554.9	4214186.3	0.0	0.0	7035064.9
36468	24	8436.0	2239965.0	3477519.7	0.0	0.0	4349380.1
36764	21	11609.1	2522048.3	4171105.2	0.0	0.0	7478959.5
37065	18	6580.7	1538742.8	4427519.0	0.0	0.0	8706573.7
37372	22	103466.6	2480333.4	4042600.0	0.0	0.0	7316350.6
37683	25	16919.1	2448663.4	4677946.6	0.0	0.0	8010830.9
38000	22	186474.2	2768929.2	4103483.9	0.0	0.0	8191307.4
38322	14	5888.1	2434921.1	3537993.0	0.0	0.0	8065466.5
38649	27	5338.7	1311577.5	3612051.3	0.0	0.0	3746657.3
38983	22	4800.1	1681752.4	4004852.6	0.0	0.0	8127203.7
39322	14	4447.0	1805699.7	6064067.0	0.0	0.0	7079414.8
39667	15	5218.4	1995400.8	4428245.5	0.0	0.0	6667862.9
40018	16	7185.1	1780044.2	3522265.6	0.0	0.0	5494762.2

40375	15	5256.4	2070195.9	5455791.2	0.0	0.0	6750507.1
40739	18	8298.8	2252032.1	4263834.0	0.0	0.0	5847686.3
41109	19	7457.6	1899519.8	3988160.2	0.0	0.0	7776777.5
41486	21	6363.3	1696310.8	4065552.1	0.0	0.0	4386599.8
41870	19	5550.9	990839.8	3796278.7	0.0	0.0	4321373.1
42262	26	4316.4	1891272.8	3916479.6	0.0	0.0	5517925.8
42660	26	6429.6	1207485.0	2966800.3	0.0	0.0	5653617.6
43067	15	140646.5	3001090.4	4171699.8	0.0	0.0	7339826.9
43481	18	5056.2	1999579.7	4415870.6	0.0	0.0	7114636.2
43903	18	310953.2	1548056.2	4195769.6	0.0	0.0	4200284.5
44333	18	11357.5	1947690.1	4393927.0	0.0	0.0	7107112.0
44772	19	577020.6	2993533.5	4308626.5	0.0	0.0	6338630.5
45220	16	456580.3	3926041.9	7673576.1	0.0	0.0	8717222.1
45677	21	8543.1	2282266.6	3838496.8	0.0	0.0	6136017.3
46143	22	5835.8	2192788.4	3970335.0	0.0	0.0	4163572.7
46618	17	96909.7	2370083.3	3981816.8	0.0	0.0	4350711.1
47104	18	5251.8	2499987.7	4993158.2	0.0	0.0	7803140.4
47600	12	6233.2	2038971.9	3715184.7	0.0	0.0	4202296.7
48106	13	780149.4	2655811.1	4178619.8	0.0	0.0	5591515.5
48623	19	19132.8	1932097.0	5016643.5	0.0	0.0	6859041.4
49152	23	15004.4	1190739.7	3915581.3	0.0	0.0	6645718.0
49692	24	4784.9	1690732.3	5984398.1	0.0	0.0	7708758.0
50244	23	7458.9	1881555.9	4074470.8	0.0	0.0	8431082.6
50809	13	6570.0	1149854.8	2924406.7	0.0	0.0	6118441.9
51386	22	19442.5	2437675.0	3706403.9	0.0	0.0	6309753.6
51977	20	7156.0	1440414.6	4096867.4	0.0	0.0	5012484.8
52581	16	9234.1	2196024.7	4319841.2	0.0	0.0	5596252.3
53200	17	586454.9	3038631.6	8281473.0	0.0	0.0	8770810.3
53833	18	11563.9	1537000.7	4129379.6	0.0	0.0	4288516.5
54482	13	11267.6	1889035.6	3071288.1	0.0	0.0	4672958.6
55146	19	9221.1	1592627.8	4903382.9	0.0	0.0	8764961.4
55827	19	8613.6	1577039.3	4198286.7	0.0	0.0	7186437.3
56525	10	280757.6	1594202.2	7164767.4	0.0	0.0	7164767.4
57240	18	12007.2	1455518.9	5467617.8	0.0	0.0	5902563.0
57974	15	7923.2	1952920.4	4021884.0	0.0	0.0	4089934.6
58727	13	1095159.6	2222524.0	6746940.6	0.0	0.0	8209284.9
59500	19	17039.5	1113315.3	3866810.9	0.0	0.0	5300142.7
60293	16	11266.7	2911556.5	3733483.6	0.0	0.0	3819122.1
61108	19	13948.9	1263334.8	2905832.5	0.0	0.0	3200106.3
61945	16	9218.1	1556337.5	4472555.5	0.0	0.0	7460841.5
62805	14	7877.6	1306624.4	4068791.0	0.0	0.0	4824169.9
63690	19	11913.3	2072523.5	3958366.0	0.0	0.0	6951019.9
64600	15	57697.0	2543930.3	4064536.0	0.0	0.0	8267643.3

65536	20	13398.9	2175084.0	4118929.7	0.0	0.0	8691882.3
65902	16	12203.4	988965.3	2546168.0	0.0	0.0	3557014.6
66272	24	11573.3	1184431.0	3789546.2	0.0	0.0	4128139.7
66647	18	155148.3	2640172.4	3702173.3	0.0	0.0	3971548.1
67025	26	10479.2	2792674.6	4039760.7	0.0	0.0	4265441.1
67408	12	13573.8	1694430.4	4320651.5	0.0	0.0	8684593.2
67796	16	405839.3	2367758.7	4423190.5	0.0	0.0	7818156.0
68188	20	13507.3	1282951.9	3664028.3	0.0	0.0	4116124.8
68584	14	10069.4	2268377.1	4276114.4	0.0	0.0	7157685.7
68985	20	13022.5	1883262.1	4467179.2	0.0	0.0	8570034.3
69391	12	12929.3	2404355.6	4465473.8	0.0	0.0	7231384.0
69802	16	42331.5	1628935.9	3327404.2	0.0	0.0	3348144.4
70217	21	7597.4	1771123.7	3778042.6	0.0	0.0	7635400.8
70638	20	8353.0	1444715.2	4093553.4	0.0	0.0	6970439.8
71063	26	11698.4	2656171.2	4382689.6	0.0	0.0	6836141.9
71494	26	26824.9	1937979.1	3901925.3	0.0	0.0	7207180.4
71930	21	14824.3	1681733.2	5542325.1	0.0	0.0	7744046.7
72371	16	26846.9	1961697.0	3977185.5	0.0	0.0	4134090.0
72818	18	67623.9	2207733.3	3914056.2	0.0	0.0	5172515.0
73270	25	18297.6	702110.4	3757522.0	0.0	0.0	4441924.2
73728	31	10659.1	2102771.8	4030501.1	0.0	0.0	6305006.8
74192	20	173801.2	1841816.4	3017650.3	0.0	0.0	3907952.0
74661	19	13749.8	2472805.1	4058812.6	0.0	0.0	8758123.6
75137	20	11802.9	1051960.7	3923089.5	0.0	0.0	5454473.2
75618	16	9295.7	1340232.5	3252077.8	0.0	0.0	4104432.7
76106	20	439577.8	2930168.3	4162209.6	0.0	0.0	5236152.5
76601	18	90289.8	2651549.2	4332389.1	0.0	0.0	4332521.9
77101	15	21496.3	872319.5	3625203.4	0.0	0.0	4502631.8
77608	11	15217.0	925931.5	3044332.5	0.0	0.0	7478245.0
78122	25	16044.5	2180793.3	3614183.8	0.0	0.0	7932157.2
78643	20	13990.6	2685670.6	6132769.0	0.0	0.0	8061051.7
79171	19	16960.7	2178032.0	4320124.3	0.0	0.0	8246674.5
79706	15	290767.9	2171103.1	4466408.4	0.0	0.0	5998548.4
80248	11	315104.8	1632102.4	3024548.6	0.0	0.0	3188568.3
80798	16	21626.8	1805145.3	3585097.8	0.0	0.0	3940500.8
81355	17	15807.8	2348082.8	6039212.0	0.0	0.0	8257784.9
81920	27	59471.4	2969933.3	4220069.5	0.0	0.0	7800098.1
82493	17	204345.2	1748100.9	4251885.6	0.0	0.0	5976366.8
83074	15	31078.1	1245773.9	3485571.4	0.0	0.0	4138961.3
83663	20	46572.0	1824253.8	4285226.0	0.0	0.0	4513174.8
84261	14	58780.8	1814971.3	3776978.1	0.0	0.0	4030222.8
84867	13	16990.5	1509451.5	3564751.9	0.0	0.0	3786019.9
85482	22	23630.5	1848182.0	4224615.1	0.0	0.0	6381804.4

86106	20	75657.9	1650073.9	3870580.5	0.0	0.0	7147696.1
86739	12	20754.8	1992131.8	3374291.7	0.0	0.0	3993113.3
87381	13	20575.9	664489.0	3329115.6	0.0	0.0	3838575.6
88033	19	20807.9	2355367.5	7187530.0	0.0	0.0	8108481.8
88695	20	18071.4	1704641.6	5573579.2	0.0	0.0	6024760.9
89367	25	17627.3	2831143.2	3846073.3	0.0	0.0	8657878.6
90049	25	19951.9	1835407.3	4596688.9	0.0	0.0	5840057.5
90742	17	25735.8	1652347.9	3659429.4	0.0	0.0	4047123.4
91446	20	13525.1	1972487.1	4130148.0	0.0	0.0	4476606.7
92160	24	14333.6	1798811.1	4093331.8	0.0	0.0	8596957.5
92886	20	13556.0	2163593.1	4115629.3	0.0	0.0	4344899.9
93623	25	23665.3	2231262.4	3850149.9	0.0	0.0	4187578.1
94372	15	31977.3	2095499.4	3713097.5	0.0	0.0	3724843.5
95133	25	16039.8	866852.4	3948385.9	0.0	0.0	4441676.7
95906	21	19984.9	849441.6	3346988.2	0.0	0.0	6587824.2
96692	18	14524.8	2021846.5	4433764.8	0.0	0.0	4485860.4
97492	17	23193.0	2017417.3	4015188.3	0.0	0.0	4132048.0
98304	23	19096.8	2025912.0	3865910.5	0.0	0.0	8618226.8
99130	27	9802.4	1635514.9	4772334.4	0.0	0.0	7788719.0
99970	18	16583.4	2514637.8	4218189.0	0.0	0.0	4265679.1
100825	18	480628.4	3065992.0	7856105.2	0.0	0.0	8517912.0
101694	20	19982.9	2090954.1	5862480.9	0.0	0.0	8220462.8
102578	23	412821.7	2691931.2	4329125.2	0.0	0.0	5201392.5
103478	25	19686.5	2202781.3	4314504.4	0.0	0.0	7435109.7
104394	12	24398.5	2605610.2	4492958.7	0.0	0.0	8389200.8
105326	21	42465.2	2787997.4	3860194.3	0.0	0.0	3963757.7
106275	19	25557.1	1847876.5	4449459.6	0.0	0.0	5165031.9
107241	14	250781.1	1220530.6	2504936.5	0.0	0.0	3247015.2
108225	23	265774.8	2365364.3	3941897.4	0.0	0.0	6691886.1
109227	17	26810.9	2068031.7	4068059.0	0.0	0.0	7732481.4
110247	14	76277.3	1812527.4	3869088.9	0.0	0.0	4277046.9
111288	22	29092.7	2665624.1	4050517.7	0.0	0.0	8727840.3
112347	21	25457.0	1817832.1	3355504.5	0.0	0.0	6946488.3
113428	22	24564.4	920354.1	3023884.5	0.0	0.0	8048322.5
114529	29	14957.5	1297884.1	3637334.0	0.0	0.0	4224669.7
115652	24	64966.2	2287589.5	4120216.7	0.0	0.0	4194709.7
116797	17	14632.0	1661282.8	3679566.3	0.0	0.0	3878169.8
117965	21	213277.1	2409944.7	3435550.2	0.0	0.0	5793813.6
119156	23	847185.8	2495965.2	3919813.0	0.0	0.0	4160160.7
120372	24	34433.1	2485987.7	4259474.0	0.0	0.0	7548459.6
121613	19	38224.0	2275651.6	4422671.2	0.0	0.0	7385881.2
122880	27	39825.6	1421361.5	3782589.1	0.0	0.0	4187576.2
124173	18	439030.8	2884211.5	6615186.3	0.0	0.0	8336415.5



125494	24	548596.3	3023194.5	4384470.6	0.0	0.0	6110284.6
126844	14	49321.3	2319320.2	5147887.5	0.0	0.0	6066274.5
128223	12	87638.2	2080566.8	3062663.5	0.0	0.0	3936966.2
129632	27	33633.8	1305109.1	3491329.0	0.0	0.0	3729627.4
131072	21	22144.6	2640223.4	3811501.7	0.0	0.0	4556603.8
131630	3	2680194.9	3847284.1	0.0	0.0	0.0	4170294.9
132192	1	284093.2	284093.2	0.0	0.0	0.0	284093.2
133332	5	321365.1	2856453.8	0.0	0.0	0.0	4013997.4
133909	5	284984.3	1495157.3	0.0	0.0	0.0	3909488.2
134491	6	405227.5	1319322.5	0.0	0.0	0.0	3697133.5
135079	7	168977.8	2523766.4	0.0	0.0	0.0	3848336.0
135671	3	428311.5	2094886.8	0.0	0.0	0.0	8648407.3
136269	3	2855827.9	3114381.5	0.0	0.0	0.0	4210333.8
136872	5	188422.1	783791.6	0.0	0.0	0.0	1485449.8
137480	5	470858.2	1597528.0	0.0	0.0	0.0	3392342.9
138094	6	24990.9	3073542.9	0.0	0.0	0.0	5916288.3
138713	8	799592.4	2894401.2	0.0	0.0	0.0	3938768.9
139338	5	52189.7	834026.9	0.0	0.0	0.0	6674287.1
139968	2	202330.6	3828372.4	0.0	0.0	0.0	3828372.4
140605	4	429692.3	2015965.8	0.0	0.0	0.0	2057218.7
141247	6	291912.8	2258690.8	0.0	0.0	0.0	6638028.6
141894	4	33135.3	1261559.1	0.0	0.0	0.0	1704818.3
142548	8	144558.0	1862121.1	0.0	0.0	0.0	4241814.8
143208	3	46815.6	49499.4	0.0	0.0	0.0	4215185.1
143874	5	111174.0	716252.1	0.0	0.0	0.0	3594689.8
144547	6	725764.1	1907719.3	0.0	0.0	0.0	3872244.9
145225	4	101158.6	711106.8	0.0	0.0	0.0	2347807.4
145910	5	383524.3	1471147.6	0.0	0.0	0.0	3278640.2
146602	7	239197.0	2223496.0	0.0	0.0	0.0	4233180.1
147300	2	31915.7	1019800.7	0.0	0.0	0.0	1019800.7
148005	8	46199.5	2865872.5	0.0	0.0	0.0	7412499.5
148716	2	1374114.9	2860896.8	0.0	0.0	0.0	2860896.8
149435	4	26553.4	1871835.1	0.0	0.0	0.0	3310393.1
150160	3	2390572.5	2632939.1	0.0	0.0	0.0	3404527.1
150893	10	27061.2	1859765.6	5709345.9	0.0	0.0	5709345.9
151632	5	109849.4	1684267.4	0.0	0.0	0.0	2739065.5
152379	8	301915.4	3174307.7	0.0	0.0	0.0	3990427.0
153134	4	965097.7	1878722.6	0.0	0.0	0.0	2587640.5
153895	4	1377017.1	3414721.9	0.0	0.0	0.0	3432322.0
154665	3	1247533.0	3306066.0	0.0	0.0	0.0	3569461.8
155442	5	60657.1	411468.0	0.0	0.0	0.0	4113874.3
156227	6	1149918.8	2566460.3	0.0	0.0	0.0	8097700.1
157020	9	59289.2	467512.8	0.0	0.0	0.0	3986711.0

157821	4	65416.0	2611299.6	0.0	0.0	0.0	2895086.3
158631	4	155004.7	3128226.6	0.0	0.0	0.0	4236368.3
159448	2	622326.7	4404808.6	0.0	0.0	0.0	4404808.6
160275	1	2842597.8	2842597.8	0.0	0.0	0.0	2842597.8
161109	9	30132.7	1786364.8	0.0	0.0	0.0	3916746.7
161953	7	56055.1	1903771.2	0.0	0.0	0.0	4090062.5
162805	4	33182.3	2223157.7	0.0	0.0	0.0	3080714.1
163667	1	1316689.2	1316689.2	0.0	0.0	0.0	1316689.2
164537	5	134227.8	2532742.7	0.0	0.0	0.0	8479721.6
165417	1	268335.7	268335.7	0.0	0.0	0.0	268335.7
166306	3	790116.6	908313.8	0.0	0.0	0.0	4066940.6
167205	1	4638589.4	4638589.4	0.0	0.0	0.0	4638589.4
168114	5	289094.7	3102014.6	0.0	0.0	0.0	4019977.7
169033	4	916494.6	2944793.9	0.0	0.0	0.0	3485472.0
169961	5	424112.7	1248991.9	0.0	0.0	0.0	4756782.3
170901	3	1940603.6	2022424.8	0.0	0.0	0.0	5534223.6
171850	6	1770104.3	3990379.0	0.0	0.0	0.0	7076141.1
172810	3	55360.5	279410.4	0.0	0.0	0.0	2555836.4
173781	4	2186271.9	2774121.0	0.0	0.0	0.0	7711015.3
174763	5	225030.1	2144296.7	0.0	0.0	0.0	3745156.1
175756	6	83210.2	2153952.2	0.0	0.0	0.0	4449843.2
176760	2	566121.2	1206954.5	0.0	0.0	0.0	1206954.5
177776	7	89246.7	2021515.1	0.0	0.0	0.0	3570278.1
178803	4	170642.7	1953423.9	0.0	0.0	0.0	2435607.4
179843	10	105016.2	1282346.8	4320109.3	0.0	0.0	4320109.3
180895	2	1611668.8	1847867.1	0.0	0.0	0.0	1847867.1
181959	3	324469.5	2116909.1	0.0	0.0	0.0	6765417.7
183035	3	1667298.0	2155869.9	0.0	0.0	0.0	3364678.1
184125	13	136596.4	2020752.6	3701651.5	0.0	0.0	3739092.2
185227	6	129789.7	2781885.4	0.0	0.0	0.0	3351656.1
186343	4	127671.1	2841530.3	0.0	0.0	0.0	2990161.0
187473	6	577083.2	2689524.6	0.0	0.0	0.0	5277823.0
188616	5	659968.3	1949193.8	0.0	0.0	0.0	3892092.2
189773	3	2715153.1	3103487.0	0.0	0.0	0.0	4313625.3
190944	5	528520.1	3729106.9	0.0	0.0	0.0	8384756.7
192130	7	614459.0	2716118.4	0.0	0.0	0.0	4511713.3
193331	6	239590.8	2553486.4	0.0	0.0	0.0	3931435.3
194547	4	702996.6	1992287.8	0.0	0.0	0.0	2550594.4
195778	4	343127.0	1966289.3	0.0	0.0	0.0	2293119.2
197025	5	2473492.4	3179982.3	0.0	0.0	0.0	4464487.5
198288	3	457805.3	1316021.8	0.0	0.0	0.0	3619324.6
199568	5	76058.5	1070895.2	0.0	0.0	0.0	2430037.2
200864	1	924432.7	924432.7	0.0	0.0	0.0	924432.7

202176	4	618452.0	2178502.8	0.0	0.0	0.0	2854113.7
203507	2	330360.2	2068174.0	0.0	0.0	0.0	2068174.0
204854	7	129253.2	2947409.2	0.0	0.0	0.0	3824298.5
206220	4	261925.7	3842010.8	0.0	0.0	0.0	4714405.9
207604	3	676711.3	1447700.3	0.0	0.0	0.0	3234207.7
209007	4	255825.9	3125137.4	0.0	0.0	0.0	4464077.1
210429	11	232838.5	2825953.5	3657259.1	0.0	0.0	5379847.0
211870	2	1406518.6	3478176.2	0.0	0.0	0.0	3478176.2
213331	3	2099931.5	2894260.1	0.0	0.0	0.0	3509581.0
214812	8	506027.5	2303192.0	0.0	0.0	0.0	3104203.9
216315	6	90070.0	2589801.8	0.0	0.0	0.0	3482989.6
217838	4	1473001.8	2723184.3	0.0	0.0	0.0	4169129.7
219383	5	401008.5	2104366.4	0.0	0.0	0.0	4285805.4
220950	6	471109.8	3230556.4	0.0	0.0	0.0	7985610.0
222540	3	436866.5	1272802.9	0.0	0.0	0.0	2707098.5
224152	7	534122.6	3095102.7	0.0	0.0	0.0	3728936.8
225788	4	394756.6	3360219.1	0.0	0.0	0.0	4369533.0
227448	4	414660.5	987775.8	0.0	0.0	0.0	2074574.8
229133	4	1351167.2	6212321.8	0.0	0.0	0.0	7040179.7
230843	5	194096.1	2697359.4	0.0	0.0	0.0	3154455.7
232579	3	507457.2	2592699.7	0.0	0.0	0.0	7544083.8
234341	1	1948407.4	1948407.4	0.0	0.0	0.0	1948407.4
236130	3	73991.1	747382.6	0.0	0.0	0.0	3587488.1
237946	7	616992.8	1296555.0	0.0	0.0	0.0	4486769.8
239791	9	233768.0	1688008.8	0.0	0.0	0.0	3059420.1
241664	2	1360710.8	2716310.3	0.0	0.0	0.0	2716310.3
243567	4	388433.2	2616921.7	0.0	0.0	0.0	6902904.8
245500	6	258307.0	3456202.4	0.0	0.0	0.0	3965230.9
247464	3	361770.3	1494485.5	0.0	0.0	0.0	7019339.0
249460	5	841247.8	2008854.8	0.0	0.0	0.0	3612722.7
251488	4	407907.7	1684766.4	0.0	0.0	0.0	3073671.1
253549	6	466228.9	1990541.5	0.0	0.0	0.0	3481295.4
255645	4	324904.8	1242876.2	0.0	0.0	0.0	1615040.5
257775	1	245211.9	245211.9	0.0	0.0	0.0	245211.9
259941	5	417923.5	2228115.7	0.0	0.0	0.0	2837028.9
262144	4	2200453.0	3207790.2	0.0	0.0	0.0	4131181.8
263003	3	1536012.0	1738329.3	0.0	0.0	0.0	2398753.4
264739	2	646811.2	4122062.6	0.0	0.0	0.0	4122062.6
265616	2	880122.2	3069098.1	0.0	0.0	0.0	3069098.1
266499	5	693143.4	3466080.0	0.0	0.0	0.0	4089929.7
267387	2	2762766.7	4020323.3	0.0	0.0	0.0	4020323.3
268281	1	874761.1	874761.1	0.0	0.0	0.0	874761.1
269181	3	1201975.4	1476975.3	0.0	0.0	0.0	3776944.9

270088	4	2917828.3	3784437.0	0.0	0.0	0.0	5994712.8
271000	1	3870132.2	3870132.2	0.0	0.0	0.0	3870132.2
271919	1	3475880.3	3475880.3	0.0	0.0	0.0	3475880.3
272844	2	720237.4	898272.1	0.0	0.0	0.0	898272.1
273775	1	472104.3	472104.3	0.0	0.0	0.0	472104.3
274713	2	1530058.6	4308803.7	0.0	0.0	0.0	4308803.7
275657	6	683247.2	2025942.4	0.0	0.0	0.0	4174293.3
276607	2	1055008.9	1356166.6	0.0	0.0	0.0	1356166.6
277564	4	372332.0	3283374.3	0.0	0.0	0.0	4544455.0
278528	5	2348852.7	2451095.6	0.0	0.0	0.0	4110494.8
279498	1	2726970.0	2726970.0	0.0	0.0	0.0	2726970.0
280476	4	2593974.0	4246031.9	0.0	0.0	0.0	6204540.9
281460	3	165717.4	1012508.7	0.0	0.0	0.0	4145854.0
283449	1	1381414.0	1381414.0	0.0	0.0	0.0	1381414.0
284454	3	2314310.7	2545167.4	0.0	0.0	0.0	3069126.9
285466	1	643062.5	643062.5	0.0	0.0	0.0	643062.5
287513	6	187729.0	4108202.4	0.0	0.0	0.0	8340986.2
288547	4	770014.5	2140250.0	0.0	0.0	0.0	4004795.8
289589	2	800771.7	2765811.3	0.0	0.0	0.0	2765811.3
290638	4	436566.3	4103588.4	0.0	0.0	0.0	4247529.6
291695	1	844705.6	844705.6	0.0	0.0	0.0	844705.6
292759	4	523117.1	1363888.7	0.0	0.0	0.0	4212085.5
294912	4	501770.3	1600872.1	0.0	0.0	0.0	3917703.2
296000	5	147244.9	3929788.0	0.0	0.0	0.0	4584783.0
298201	5	187450.2	794508.5	0.0	0.0	0.0	8501233.2
299314	3	1717774.9	2393627.5	0.0	0.0	0.0	3183038.2
300435	2	1273115.1	1771835.6	0.0	0.0	0.0	1771835.6
301564	1	1740024.7	1740024.7	0.0	0.0	0.0	1740024.7
302702	1	596229.6	596229.6	0.0	0.0	0.0	596229.6
303849	5	372091.6	1267463.4	0.0	0.0	0.0	2884385.2
305004	5	505667.1	2345400.4	0.0	0.0	0.0	6288883.1
307341	2	4911378.1	4971634.5	0.0	0.0	0.0	4971634.5
308523	1	517514.4	517514.4	0.0	0.0	0.0	517514.4
309715	2	362546.4	3635210.5	0.0	0.0	0.0	3635210.5
310915	6	529248.9	2163028.7	0.0	0.0	0.0	3636575.1
312125	3	2420523.6	2436566.7	0.0	0.0	0.0	3108292.2
313344	2	1517081.7	3167237.6	0.0	0.0	0.0	3167237.6
314573	2	191100.8	2131044.8	0.0	0.0	0.0	2131044.8
315811	4	2482519.0	3481805.3	0.0	0.0	0.0	4878363.1
317060	5	869106.2	1032323.9	0.0	0.0	0.0	3256208.6
318318	2	889986.4	4836556.8	0.0	0.0	0.0	4836556.8
319586	4	998575.2	2264926.3	0.0	0.0	0.0	2411224.1
320864	3	864925.4	1526978.7	0.0	0.0	0.0	4926457.3

322153	4	649679.7	3309003.2	0.0	0.0	0.0	3612495.0
323452	2	862970.4	2979569.3	0.0	0.0	0.0	2979569.3
324761	6	1070985.4	3148368.0	0.0	0.0	0.0	5616013.2
326082	3	2578119.4	3266890.8	0.0	0.0	0.0	3782759.8
327413	1	2685050.8	2685050.8	0.0	0.0	0.0	2685050.8
328754	1	2225698.0	2225698.0	0.0	0.0	0.0	2225698.0
330107	2	825322.2	3522056.9	0.0	0.0	0.0	3522056.9
331471	5	838831.6	945051.8	0.0	0.0	0.0	3360736.0
332847	2	1968953.9	2865203.8	0.0	0.0	0.0	2865203.8
334234	2	2206725.1	8066104.7	0.0	0.0	0.0	8066104.7
335632	3	1350245.7	2697014.9	0.0	0.0	0.0	3977376.1
338464	3	776544.9	1450258.8	0.0	0.0	0.0	4009884.9
339899	1	3749102.4	3749102.4	0.0	0.0	0.0	3749102.4
341345	1	6863660.3	6863660.3	0.0	0.0	0.0	6863660.3
342804	3	917220.5	1156618.3	0.0	0.0	0.0	5358774.5
344275	4	920316.3	6142994.1	0.0	0.0	0.0	6301482.3
345759	4	1302154.8	1518394.9	0.0	0.0	0.0	1746258.7
347256	2	392493.7	1084361.7	0.0	0.0	0.0	1084361.7
348765	5	1142649.8	1763147.2	0.0	0.0	0.0	3641681.5
350288	5	1075151.2	2037715.3	0.0	0.0	0.0	3220775.4
351825	3	627070.7	2393448.0	0.0	0.0	0.0	6092909.6
353375	2	2712623.8	4322209.7	0.0	0.0	0.0	4322209.7
354938	6	865996.5	1388355.2	0.0	0.0	0.0	4368791.4
356516	4	420356.4	1442290.0	0.0	0.0	0.0	2243124.9
358107	4	377586.5	1789557.1	0.0	0.0	0.0	4035978.6
359713	3	569396.6	1722463.3	0.0	0.0	0.0	2197732.4
361334	2	513718.5	3592976.7	0.0	0.0	0.0	3592976.7
362969	3	1238011.8	1342979.2	0.0	0.0	0.0	4093714.9
364618	4	598419.4	984016.8	0.0	0.0	0.0	1649135.6
366283	3	537016.8	1528540.1	0.0	0.0	0.0	7027323.9
367964	3	764396.5	961671.6	0.0	0.0	0.0	3225487.0
369659	4	1192879.6	2203022.1	0.0	0.0	0.0	3400965.7
371371	1	7170151.8	7170151.8	0.0	0.0	0.0	7170151.8
373098	2	2396433.5	7080318.1	0.0	0.0	0.0	7080318.1
374841	1	1378469.5	1378469.5	0.0	0.0	0.0	1378469.5
376601	1	3797055.2	3797055.2	0.0	0.0	0.0	3797055.2
378378	6	602557.6	1998806.4	0.0	0.0	0.0	3821220.4
380171	3	1396472.3	1756081.9	0.0	0.0	0.0	3340862.3
381981	4	754754.2	926434.7	0.0	0.0	0.0	1485424.2
383809	3	745197.6	2023274.1	0.0	0.0	0.0	3829583.3
385654	2	576783.4	1494090.1	0.0	0.0	0.0	1494090.1
387517	4	544447.8	840448.4	0.0	0.0	0.0	3822726.6
389398	2	1715579.4	2978252.1	0.0	0.0	0.0	2978252.1

391298	1	7370389.8	7370389.8	0.0	0.0	0.0	7370389.8
393216	4	1223399.2	1810581.7	0.0	0.0	0.0	2553239.4
395153	3	4276988.0	8229662.8	0.0	0.0	0.0	8302334.5
397109	4	693049.0	2321552.2	0.0	0.0	0.0	3223542.6
399085	2	1050303.3	3748812.3	0.0	0.0	0.0	3748812.3
401080	4	950737.7	3678572.7	0.0	0.0	0.0	4092945.9
403096	2	1679691.9	3996668.7	0.0	0.0	0.0	3996668.7
405132	3	3480614.1	3567681.3	0.0	0.0	0.0	4502139.0
407188	3	1134337.0	3002049.3	0.0	0.0	0.0	8572341.3
409266	2	861153.1	1605244.1	0.0	0.0	0.0	1605244.1
411364	1	2975850.7	2975850.7	0.0	0.0	0.0	2975850.7
413485	1	487840.5	487840.5	0.0	0.0	0.0	487840.5
415627	4	979455.5	3046008.9	0.0	0.0	0.0	4540926.9
417792	2	3343698.6	8415283.5	0.0	0.0	0.0	8415283.5
419979	1	711217.5	711217.5	0.0	0.0	0.0	711217.5
422190	4	1703024.1	4300414.7	0.0	0.0	0.0	4511604.6
424424	4	1059635.3	1936434.8	0.0	0.0	0.0	9432661.5
426681	3	1029636.3	3760967.9	0.0	0.0	0.0	3965973.2
428963	4	1713801.3	3013333.1	0.0	0.0	0.0	3735496.9
431269	4	1439007.1	3290744.3	0.0	0.0	0.0	4053280.0
433600	4	1012205.7	1171437.8	0.0	0.0	0.0	2422377.8
435957	2	3011736.1	4408319.9	0.0	0.0	0.0	4408319.9
438339	2	917710.4	3224087.6	0.0	0.0	0.0	3224087.6
443183	3	1232522.7	1436960.7	0.0	0.0	0.0	3641171.2
445645	2	1928899.3	4090076.0	0.0	0.0	0.0	4090076.0
448134	2	723146.1	3299999.7	0.0	0.0	0.0	3299999.7
453198	5	745730.2	1624669.5	0.0	0.0	0.0	3109897.9
455773	3	3177159.6	3197760.9	0.0	0.0	0.0	4520759.8
458378	4	1783896.8	2683774.1	0.0	0.0	0.0	2842506.5
461012	3	610723.4	1524001.9	0.0	0.0	0.0	1783878.4
463677	2	1453168.1	4113524.3	0.0	0.0	0.0	4113524.3
466372	2	1303112.5	2465113.7	0.0	0.0	0.0	2465113.7
469100	2	1715876.1	2533150.4	0.0	0.0	0.0	2533150.4
471859	2	927599.3	1821758.6	0.0	0.0	0.0	1821758.6
474651	6	1395638.7	2519871.4	0.0	0.0	0.0	3768343.6
480336	2	3559693.7	3767552.3	0.0	0.0	0.0	3767552.3
483229	2	1672349.1	1850344.7	0.0	0.0	0.0	1850344.7
486158	3	2028862.6	2476543.8	0.0	0.0	0.0	3230644.4
489122	2	2335323.3	3111322.1	0.0	0.0	0.0	3111322.1
492123	2	2668198.2	3962360.5	0.0	0.0	0.0	3962360.5
495161	2	1763124.6	2211073.2	0.0	0.0	0.0	2211073.2
498236	4	1816439.7	3283884.3	0.0	0.0	0.0	3709036.9
501350	6	1471253.3	2160092.5	0.0	0.0	0.0	3326181.6

504504	4	1418694.1	2574095.3	0.0	0.0	0.0	2613883.5
510930	3	1844600.8	3912030.9	0.0	0.0	0.0	4217825.1
514206	3	1204021.7	1868924.8	0.0	0.0	0.0	1988634.8
517523	1	2965431.1	2965431.1	0.0	0.0	0.0	2965431.1
520884	1	2398905.2	2398905.2	0.0	0.0	0.0	2398905.2
524288	1	1192447.8	1192447.8	0.0	0.0	0.0	1192447.8
532031	3	2499899.4	3061435.1	0.0	0.0	0.0	3577016.5
534663	1	3921672.6	3921672.6	0.0	0.0	0.0	3921672.6
540006	1	1978126.6	1978126.6	0.0	0.0	0.0	1978126.6
545458	2	2380351.9	3076864.2	0.0	0.0	0.0	3076864.2
548225	1	4467032.0	4467032.0	0.0	0.0	0.0	4467032.0
551020	2	2564988.6	4153261.4	0.0	0.0	0.0	4153261.4
553844	1	3092737.9	3092737.9	0.0	0.0	0.0	3092737.9
556697	1	2351693.1	2351693.1	0.0	0.0	0.0	2351693.1
559579	1	2262201.8	2262201.8	0.0	0.0	0.0	2262201.8
565435	1	2747876.5	2747876.5	0.0	0.0	0.0	2747876.5
568408	3	2568779.7	3035320.8	0.0	0.0	0.0	3928896.5
571414	2	3175360.7	3565414.6	0.0	0.0	0.0	3565414.6
580624	1	4180255.7	4180255.7	0.0	0.0	0.0	4180255.7
583760	3	1639688.2	1951210.6	0.0	0.0	0.0	3642155.2
586931	1	1246950.3	1246950.3	0.0	0.0	0.0	1246950.3
596652	1	2260927.5	2260927.5	0.0	0.0	0.0	2260927.5
603313	2	2018484.9	2909045.2	0.0	0.0	0.0	2909045.2
610125	5	1635182.9	1899725.0	0.0	0.0	0.0	2925891.2
613590	1	3296428.3	3296428.3	0.0	0.0	0.0	3296428.3
617093	2	1757756.2	2154206.2	0.0	0.0	0.0	2154206.2
620637	3	1734792.2	2802913.1	0.0	0.0	0.0	4343617.3
624222	1	3249390.7	3249390.7	0.0	0.0	0.0	3249390.7
627848	2	4080299.5	4129849.3	0.0	0.0	0.0	4129849.3
631517	2	2203421.8	4322550.8	0.0	0.0	0.0	4322550.8
635229	1	3363508.0	3363508.0	0.0	0.0	0.0	3363508.0
642786	1	2305446.6	2305446.6	0.0	0.0	0.0	2305446.6
646632	1	3837379.2	3837379.2	0.0	0.0	0.0	3837379.2
654463	2	2926018.7	3152992.0	0.0	0.0	0.0	3152992.0
658451	1	2301358.1	2301358.1	0.0	0.0	0.0	2301358.1
662487	1	1758249.0	1758249.0	0.0	0.0	0.0	1758249.0
674899	2	3477365.1	4757940.4	0.0	0.0	0.0	4757940.4
679140	1	2197888.0	2197888.0	0.0	0.0	0.0	2197888.0
683435	1	4040385.9	4040385.9	0.0	0.0	0.0	4040385.9
687784	1	2130472.2	2130472.2	0.0	0.0	0.0	2130472.2
692190	1	3530154.7	3530154.7	0.0	0.0	0.0	3530154.7
701172	1	4472324.6	4472324.6	0.0	0.0	0.0	4472324.6
705750	1	3669197.2	3669197.2	0.0	0.0	0.0	3669197.2

715090	1	3058019.6	3058019.6	0.0	0.0	0.0	3058019.6
719853	1	4224385.2	4224385.2	0.0	0.0	0.0	4224385.2
724680	1	4422414.8	4422414.8	0.0	0.0	0.0	4422414.8
734531	3	2750408.4	3907122.6	0.0	0.0	0.0	4591697.9
739558	1	2467817.8	2467817.8	0.0	0.0	0.0	2467817.8
760371	2	3704427.4	5506703.8	0.0	0.0	0.0	5506703.8
765759	2	4734830.4	4766948.1	0.0	0.0	0.0	4766948.1
771224	1	4458504.5	4458504.5	0.0	0.0	0.0	4458504.5
782390	1	4723597.2	4723597.2	0.0	0.0	0.0	4723597.2
788096	2	3454986.9	5391431.6	0.0	0.0	0.0	5391431.6
799760	1	4688583.4	4688583.4	0.0	0.0	0.0	4688583.4
811775	1	2178558.0	2178558.0	0.0	0.0	0.0	2178558.0
824156	3	3084280.3	3416493.2	0.0	0.0	0.0	4410369.3
830490	1	4007795.0	4007795.0	0.0	0.0	0.0	4007795.0
843453	1	4728546.8	4728546.8	0.0	0.0	0.0	4728546.8
863675	2	3858554.5	4414037.2	0.0	0.0	0.0	4414037.2
870633	1	3450650.7	3450650.7	0.0	0.0	0.0	3450650.7
877704	1	4520206.3	4520206.3	0.0	0.0	0.0	4520206.3
907174	1	4233603.6	4233603.6	0.0	0.0	0.0	4233603.6
914854	1	3186507.2	3186507.2	0.0	0.0	0.0	3186507.2
922664	1	6366653.0	6366653.0	0.0	0.0	0.0	6366653.0
938693	1	5848131.1	5848131.1	0.0	0.0	0.0	5848131.1
955288	1	7127449.7	7127449.7	0.0	0.0	0.0	7127449.7
963807	1	7342564.3	7342564.3	0.0	0.0	0.0	7342564.3
972480	1	5841923.9	5841923.9	0.0	0.0	0.0	5841923.9
990302	1	3894479.1	3894479.1	0.0	0.0	0.0	3894479.1
999461	4	3304050.1	4782134.3	0.0	0.0	0.0	5488876.8
1047917	2	5371236.0	7058508.2	0.0	0.0	0.0	7058508.2
1068642	1	8450401.1	8450401.1	0.0	0.0	0.0	8450401.1
1079314	1	8454309.6	8454309.6	0.0	0.0	0.0	8454309.6
1090202	2	6788144.2	7255964.2	0.0	0.0	0.0	7255964.2
1101312	1	4223271.1	4223271.1	0.0	0.0	0.0	4223271.1
1112651	2	3935313.5	7794825.7	0.0	0.0	0.0	7794825.7
1124225	1	8459407.7	8459407.7	0.0	0.0	0.0	8459407.7
1148112	1	6358095.2	6358095.2	0.0	0.0	0.0	6358095.2
1173036	1	7800643.8	7800643.8	0.0	0.0	0.0	7800643.8
1185908	1	7373361.9	7373361.9	0.0	0.0	0.0	7373361.9
1212519	1	4663203.0	4663203.0	0.0	0.0	0.0	4663203.0

\*\*\*\* client1.homa2.log:

1525290956.412746491 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.007, expecting 0.100, throttled 0.083

\*\*\*\* client3.homa4.log:



1525290955.981151118 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.034, expecting 0.100, throttled 0.034

\*\*\*\* client2.homa3.log:

1525290955.981415675 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.034, expecting 0.100, throttled 0.037

## Homa+Udp : W4 load

```
homa@homa1:~/platformlab/RAMCloud$ scripts/clusterperf.py --transport homa+udp -r 0
--clients 3 --servers 1 --messageSizeCDF benchmarks/homa/messageSizeCDFs/W4.txt
--targetTput 1.0 echo_workload
```

Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa1,10.145.94.33' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.  
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.

# Generated by 'clusterperf.py echoWorkload'

#

#	Size	Samples	Min	Median	90%	99%	99.9%	Max
53	9	251.9	553510.8	0.0	0.0	0.0	4504978.3	
56	8	146.1	25200.8	0.0	0.0	0.0	4900568.0	
60	6	298.9	655351.5	0.0	0.0	0.0	4165929.7	
64	16	207.7	1518607.0	3568634.4	0.0	0.0	4610672.5	
68	10	112.8	671819.2	6331277.3	0.0	0.0	6331277.3	
72	9	328.6	1020103.0	0.0	0.0	0.0	4005558.2	
77	11	179.6	903613.1	2712315.8	0.0	0.0	4678372.0	
81	5	256.6	2578.8	0.0	0.0	0.0	1752841.9	
87	11	287.0	1930521.9	4395880.1	0.0	0.0	7016637.2	
92	12	143.0	594057.9	4161614.3	0.0	0.0	4229772.4	
100	11	168.5	492.7	3157421.0	0.0	0.0	3459235.6	
109	5	321.6	1325365.5	0.0	0.0	0.0	2251883.0	
119	8	190.5	1258159.8	0.0	0.0	0.0	7407103.2	
130	8	292.4	1717126.9	0.0	0.0	0.0	4326498.4	

141	10	122.8	568004.4	7573515.4	0.0	0.0	7573515.4
154	15	156.2	1016540.0	4178739.1	0.0	0.0	4289184.1
168	7	271.4	146470.2	0.0	0.0	0.0	6146505.5
183	7	214.2	321.8	0.0	0.0	0.0	3472497.5
199	7	237.3	187010.0	0.0	0.0	0.0	2402627.7
217	7	176.8	15069.5	0.0	0.0	0.0	2599585.7
222	34	146.3	450524.7	3983958.7	0.0	0.0	7135096.7
227	32	195.5	616415.0	3149982.9	0.0	0.0	6827932.3
232	34	203.4	1419235.4	3324514.9	0.0	0.0	4900511.4
237	25	194.3	1039576.7	4262642.8	0.0	0.0	4974744.5
243	33	164.4	1134109.7	3427425.5	0.0	0.0	7292758.4
248	30	160.6	582936.8	3583497.5	0.0	0.0	4939409.5
254	37	143.3	297933.1	2596005.9	0.0	0.0	3640958.6
259	26	213.6	1045167.6	2353572.5	0.0	0.0	4907975.8
265	39	143.8	805087.4	4002959.8	0.0	0.0	5824546.2
271	36	146.3	645412.4	4117131.5	0.0	0.0	4902597.4
274	10	279.9	2594143.8	4125312.8	0.0	0.0	4125312.8
277	8	237.5	302.3	0.0	0.0	0.0	4826786.5
279	19	124.2	124842.9	3453925.5	0.0	0.0	4332768.1
282	16	312.3	2735777.1	4464683.4	0.0	0.0	4848432.3
285	19	295.8	1614768.0	3839161.5	0.0	0.0	3989132.9
288	20	192.1	25335.5	4329783.2	0.0	0.0	4363677.5
291	13	209.7	109939.2	4203566.0	0.0	0.0	4973903.3
294	11	230.3	806366.3	3682115.8	0.0	0.0	4557236.6
297	15	112.5	446593.7	3266826.4	0.0	0.0	6827357.2
300	8	254.7	3320675.7	0.0	0.0	0.0	7450168.8
303	88	90.4	554550.6	3811391.1	0.0	0.0	7757557.4
305	105	176.5	689104.3	3713199.9	7238371.0	0.0	7292406.7
308	102	208.7	916747.2	4409271.0	5887872.4	0.0	7238572.2
310	112	172.1	310481.9	3259282.2	6206628.2	0.0	6493053.7
313	117	168.1	582435.3	4213006.6	5788425.0	0.0	6314791.2
315	100	190.1	1273993.2	4886502.6	7407258.5	0.0	7407258.5
318	98	132.5	969667.2	3770629.4	0.0	0.0	4931641.4
321	106	148.1	1280641.5	4178972.6	6525191.9	0.0	7034593.5
323	100	125.7	919850.7	4121403.3	5761090.8	0.0	5761090.8
326	81	114.5	582985.5	3252405.7	0.0	0.0	4894259.0
331	66	101.6	556972.0	3570059.1	0.0	0.0	7017390.2
335	89	132.6	651439.8	4163850.4	0.0	0.0	7528356.0
340	70	155.2	789336.8	4177453.5	0.0	0.0	7527952.4
345	84	156.0	1084329.0	4838745.0	0.0	0.0	6342531.2
350	71	151.7	803023.1	3682361.6	0.0	0.0	5602151.5
355	90	200.7	880233.4	3869387.0	0.0	0.0	7503327.0
360	91	158.1	566440.9	3579265.8	0.0	0.0	7034760.9

365	60	112.6	789215.5	3423882.4	0.0	0.0	6006108.7
371	77	181.5	879776.4	3250525.5	0.0	0.0	5822154.2
376	73	139.2	669873.2	3542048.9	0.0	0.0	7592412.3
381	24	125.1	559658.1	3318235.1	0.0	0.0	4888597.0
385	21	211.3	588746.2	4156397.9	0.0	0.0	5607167.9
390	20	187.1	1352177.9	4771212.1	0.0	0.0	5561028.1
395	22	117.5	1866859.6	4299311.2	0.0	0.0	4582659.0
400	26	143.2	92485.2	4008424.1	0.0	0.0	6480661.7
405	13	218.2	346745.0	2544894.4	0.0	0.0	3885563.8
410	27	243.1	1047738.5	3898001.9	0.0	0.0	4299230.0
415	19	227.6	267120.3	3461496.9	0.0	0.0	4127094.4
420	29	204.4	1188932.7	3577764.7	0.0	0.0	5134156.0
425	23	251.7	275205.3	3458249.1	0.0	0.0	4298604.5
430	51	134.7	384642.8	4121489.4	0.0	0.0	7527984.3
435	48	139.7	269421.4	3109564.1	0.0	0.0	4904363.1
441	54	214.2	1504969.0	4175366.6	0.0	0.0	5415237.2
446	53	183.8	302708.9	3713631.2	0.0	0.0	6005215.7
452	52	149.0	581265.9	4213294.0	0.0	0.0	7057281.0
457	63	120.3	656945.8	3840110.2	0.0	0.0	7052227.9
463	51	167.6	1286242.8	4004956.4	0.0	0.0	4901653.6
468	49	253.7	1718451.6	4053483.8	0.0	0.0	4510001.7
474	52	131.9	389244.6	4157756.0	0.0	0.0	4980575.7
480	53	190.8	266679.5	3290226.5	0.0	0.0	7034674.1
491	226	106.0	884079.2	4206237.7	6480814.6	0.0	7035401.6
502	248	126.8	881117.9	4505597.1	7375282.8	0.0	7592331.1
513	238	111.2	803642.0	4420759.9	6827557.3	0.0	7407142.7
525	240	127.1	758196.1	3904557.0	7034792.7	0.0	7503362.9
537	246	136.8	828854.1	3862055.0	6347778.3	0.0	7588411.1
549	234	143.3	842707.2	4204338.2	6331465.3	0.0	7615060.2
561	213	133.0	567533.2	4172143.0	6146333.5	0.0	7615227.4
574	234	127.9	1096355.2	3919330.9	6480778.4	0.0	6930317.7
587	227	136.2	728294.3	4005751.0	6559909.3	0.0	7282294.6
600	213	122.9	1249803.8	4300835.9	6479926.0	0.0	6930112.5
607	65	174.5	558058.9	3885275.2	0.0	0.0	5678682.8
615	70	200.2	1017621.2	4121222.4	0.0	0.0	6300193.5
623	74	205.6	799515.4	3459553.2	0.0	0.0	7292362.9
630	67	229.0	895518.3	4769858.7	0.0	0.0	6343383.1
638	80	134.0	789544.1	3862717.9	0.0	0.0	6314588.4
646	67	161.0	8198.9	3141332.4	0.0	0.0	3861406.8
654	80	170.5	824809.3	4274112.6	0.0	0.0	7594197.4
662	55	133.7	414559.4	4124329.6	0.0	0.0	5659955.2
671	81	154.9	928127.6	4010400.2	0.0	0.0	6480044.1
679	71	120.3	1049412.9	3863433.7	0.0	0.0	7292813.3

685	62	187.7	612825.9	4004809.5	0.0	0.0	6480452.0
690	48	187.4	827548.0	3833874.2	0.0	0.0	6479844.8
696	44	188.0	556262.4	2702273.0	0.0	0.0	6686808.3
702	49	144.8	243916.2	4121394.1	0.0	0.0	4920199.4
707	34	178.3	1662135.7	3862272.1	0.0	0.0	5636506.0
713	50	132.7	260028.4	3929131.5	0.0	0.0	4960661.1
719	42	146.7	1294941.2	3920033.1	0.0	0.0	7017463.1
725	44	222.6	910374.4	3617159.2	0.0	0.0	4902887.8
731	54	167.4	1972057.9	4816501.0	0.0	0.0	6004520.4
737	53	132.2	893917.0	4246471.3	0.0	0.0	6986032.9
743	34	138.4	240225.1	3319608.6	0.0	0.0	4429568.2
749	35	208.0	264993.9	3914688.3	0.0	0.0	4920911.7
755	32	212.5	566893.2	3253657.0	0.0	0.0	6564940.1
762	27	195.1	697925.7	2699657.2	0.0	0.0	4006973.8
768	40	164.5	588393.8	4506807.3	0.0	0.0	4879205.4
774	26	163.8	392993.6	4008476.5	0.0	0.0	6348716.7
781	38	206.7	1015698.7	3976731.3	0.0	0.0	5416248.9
787	30	162.4	69632.1	3320280.8	0.0	0.0	6299249.9
793	36	121.5	1751910.6	4752322.2	0.0	0.0	7757587.4
800	41	220.8	715288.6	3251611.9	0.0	0.0	4927746.2
808	26	160.2	1397717.5	4902788.0	0.0	0.0	4936485.6
816	21	239.3	895654.8	3425488.0	0.0	0.0	7316425.0
825	15	252.4	1363570.2	4902579.2	0.0	0.0	4980131.6
833	21	254.1	876404.5	3679010.9	0.0	0.0	4934722.5
841	24	272.7	544980.8	3376256.1	0.0	0.0	6332608.7
850	17	195.1	1017336.7	4414196.3	0.0	0.0	4848230.8
859	24	164.3	2306749.5	4910318.9	0.0	0.0	5158622.4
867	20	222.3	792533.4	4468363.8	0.0	0.0	4923263.4
876	19	203.2	1578347.0	3621756.4	0.0	0.0	7152203.1
885	25	200.5	7428.6	3884604.0	0.0	0.0	4906661.7
900	30	166.5	272812.5	4655827.2	0.0	0.0	5824746.2
914	24	167.3	617123.8	2444005.5	0.0	0.0	3651446.9
929	26	232.6	2290292.3	4908783.8	0.0	0.0	5152092.3
945	23	155.8	733196.9	3253567.5	0.0	0.0	4847622.4
960	22	261.0	410151.3	3841723.2	0.0	0.0	7528391.5
976	28	220.5	430130.7	4901396.8	0.0	0.0	5824947.1
992	32	227.5	754153.4	3411717.5	0.0	0.0	6147136.8
1009	28	156.5	383.6	3029482.9	0.0	0.0	4978882.6
1025	16	215.1	1021352.4	4976163.5	0.0	0.0	5308888.4
1042	31	197.2	895687.6	3839082.6	0.0	0.0	5534522.2
1063	20	266.4	787343.0	4613296.8	0.0	0.0	7450368.1
1085	25	176.1	636564.2	3030336.4	0.0	0.0	4931252.4
1108	26	136.8	732486.8	2659032.2	0.0	0.0	4173867.4

1130	26	256.4	541414.0	4051432.2	0.0	0.0	7176964.2
1154	21	198.7	2683.2	1946608.2	0.0	0.0	4929101.9
1177	27	176.7	24531.7	4929553.9	0.0	0.0	5496477.6
1201	28	200.6	305280.9	2749683.6	0.0	0.0	5620241.5
1226	23	248.3	617838.1	4202072.8	0.0	0.0	5560288.4
1251	30	206.5	555615.7	3268092.9	0.0	0.0	3813728.1
1277	29	147.3	561265.9	2302228.1	0.0	0.0	4920302.9
1290	19	275.1	2558617.5	4839318.2	0.0	0.0	4839767.9
1303	19	228.4	736007.2	3884833.1	0.0	0.0	7016817.8
1316	11	272.0	502631.8	4546719.6	0.0	0.0	4904271.5
1330	13	340.4	2225686.1	4909893.0	0.0	0.0	4920975.8
1343	17	272.0	2546557.6	4848024.0	0.0	0.0	4896551.4
1357	17	192.9	581175.1	4980962.3	0.0	0.0	6524988.9
1371	17	285.2	1576694.6	4525000.4	0.0	0.0	4752145.9
1385	22	225.8	1020622.6	4178053.8	0.0	0.0	4906850.2
1399	17	264.2	113876.6	2751378.1	0.0	0.0	5447586.2
1413	13	240.7	346714.2	2870231.0	0.0	0.0	3617083.2
1425	6	223.4	262313.5	0.0	0.0	0.0	3385522.4
1436	8	558475.5	3426671.4	0.0	0.0	0.0	7057732.7
1448	8	208.0	1040628.8	0.0	0.0	0.0	3877417.7
1460	12	214.8	583715.3	7016825.9	0.0	0.0	7375488.7
1472	10	244.4	692243.6	2522861.7	0.0	0.0	2522861.7
1484	11	310.6	647320.2	2650856.9	0.0	0.0	3883742.2
1497	11	239.2	587724.6	2590968.3	0.0	0.0	4977576.8
1509	10	261.0	229554.8	5560349.1	0.0	0.0	5560349.1
1521	12	188.6	1086071.6	2297275.6	0.0	0.0	3582665.7
1534	9	252.8	2104232.1	0.0	0.0	0.0	4926225.4
1547	27	162.9	1020617.8	3028838.7	0.0	0.0	4908673.5
1559	24	142.4	1780858.6	4122193.5	0.0	0.0	6286638.7
1572	28	193.9	2141555.6	4122895.2	0.0	0.0	4428321.6
1585	16	233.9	302678.6	2348037.1	0.0	0.0	3303642.8
1598	28	230.4	106911.5	2773372.3	0.0	0.0	4104866.1
1611	25	297.2	1604259.9	5465753.4	0.0	0.0	7292974.6
1624	33	218.7	1408929.2	3927787.1	0.0	0.0	7451261.1
1637	20	245.3	2403429.7	4875448.9	0.0	0.0	4893021.4
1651	25	243.4	394987.1	5415795.3	0.0	0.0	6827758.7
1664	26	164.1	1268204.3	4901587.7	0.0	0.0	7592251.2
1712	7	245.4	1121928.1	0.0	0.0	0.0	4202793.8
1762	11	206.2	326362.3	4535345.6	0.0	0.0	5607213.0
1813	13	222.2	697037.2	2349488.9	0.0	0.0	3179538.5
1865	9	122.2	369.4	0.0	0.0	0.0	4333425.5
1919	8	258.9	3100887.3	0.0	0.0	0.0	4176114.5
1975	14	194.7	446325.2	2342760.1	0.0	0.0	2589472.2

2032	14	223.7	298508.7	3712854.3	0.0	0.0	3864369.8
2091	6	260.8	1385228.5	0.0	0.0	0.0	2191957.6
2152	9	241.5	446.3	0.0	0.0	0.0	4158276.9
2214	5	252.4	364778.3	0.0	0.0	0.0	4815528.0
2311	10	284.4	2433323.5	4978292.5	0.0	0.0	4978292.5
2412	11	213.9	1263854.8	4321480.0	0.0	0.0	6004330.3
2517	10	498.2	2556749.9	4945314.5	0.0	0.0	4945314.5
2627	9	249.5	34182.0	0.0	0.0	0.0	4176190.2
2742	10	365.4	2175930.0	2623044.8	0.0	0.0	2623044.8
2862	22	251.2	246864.9	3064774.7	0.0	0.0	4064806.0
2987	10	205.0	27637.4	1576174.6	0.0	0.0	1576174.6
3118	7	294.6	516.5	0.0	0.0	0.0	3386856.5
3254	10	425.2	1199949.0	6010599.1	0.0	0.0	6010599.1
3396	14	377.7	593921.8	3918890.1	0.0	0.0	4009062.6
3544	14	383.5	947469.8	2598879.3	0.0	0.0	5196489.7
3699	15	339.8	381065.1	6354294.1	0.0	0.0	7502913.9
3861	12	403.9	1421357.0	3137422.4	0.0	0.0	3282643.6
4030	14	279.9	297518.2	3288958.5	0.0	0.0	3891751.1
4206	11	360.5	2031160.3	4906165.4	0.0	0.0	4930556.5
4390	11	278.0	595805.5	2237931.5	0.0	0.0	4726752.0
4582	11	318.0	588346.5	3025276.9	0.0	0.0	4687510.7
4783	10	274.6	620625.1	4385811.5	0.0	0.0	4385811.5
4992	10	493.1	347240.2	4928612.5	0.0	0.0	4928612.5
5210	8	372.1	1097533.4	0.0	0.0	0.0	3074996.5
5427	23	303.0	1030645.8	3099305.4	0.0	0.0	5823440.2
5652	15	428.6	827415.3	5824585.5	0.0	0.0	6343434.4
5887	22	303.3	2730.3	3881597.3	0.0	0.0	5135086.4
6132	13	367.1	1016871.8	3615278.3	0.0	0.0	3714374.4
6387	21	354.9	344383.0	3789756.0	0.0	0.0	5606759.3
6653	24	352.6	1614263.8	3874665.4	0.0	0.0	7587960.5
6929	26	348.5	915592.3	4463368.5	0.0	0.0	5426887.3
7217	24	550.8	1308121.3	3932313.6	0.0	0.0	4415726.5
7517	24	480.3	1085859.3	4058187.0	0.0	0.0	4903491.1
7830	21	420.3	512093.3	3353457.0	0.0	0.0	4909579.8
9012	14	409.2	294768.5	3149538.7	0.0	0.0	3424234.9
10373	12	391.0	332309.0	3261179.3	0.0	0.0	3883521.4
11939	23	912.6	790001.7	4612630.7	0.0	0.0	7591797.9
13741	19	768.1	451167.3	3890975.8	0.0	0.0	4250258.2
15816	19	1044.0	1100959.2	4911380.3	0.0	0.0	6564745.8
18203	10	1504.3	2764243.8	4931956.0	0.0	0.0	4931956.0
20952	14	1125.2	2095.1	5589204.7	0.0	0.0	6985826.9
24115	19	1792.2	1041447.3	4345299.4	0.0	0.0	4982042.6
27756	12	2098.3	2473050.4	4848027.3	0.0	0.0	7363365.5

31946	16	1955.6	1729345.9	3032700.6	0.0	0.0	3254377.2
32405	17	2046.5	557269.6	2872677.6	0.0	0.0	3919714.1
32871	9	2185.0	14371.1	0.0	0.0	0.0	3412509.4
33343	12	2052.6	114334.6	2182254.0	0.0	0.0	2350778.3
33822	13	1936.5	13915.3	1283907.8	0.0	0.0	2338164.6
34308	15	2083.8	897879.3	4268818.1	0.0	0.0	4919776.7
34801	17	2550.9	2094081.5	4547331.6	0.0	0.0	5583367.2
35301	7	2353.4	29952.9	0.0	0.0	0.0	3671044.2
35808	9	1981.3	256419.2	0.0	0.0	0.0	4817116.5
36322	6	2531.2	800245.1	0.0	0.0	0.0	2351976.7
36844	13	2222.5	561046.9	2869041.2	0.0	0.0	3863631.6
37146	10	13026.2	2241806.3	5368376.2	0.0	0.0	5368376.2
37450	17	1976.3	602004.7	4058690.2	0.0	0.0	4428885.0
37756	15	2231.3	1631336.3	4214102.3	0.0	0.0	5755846.5
38065	14	2392.6	7797.7	3109607.8	0.0	0.0	5406577.6
38377	15	2137.6	24139.3	2631200.8	0.0	0.0	4934582.8
38691	12	2384.1	895175.0	2636691.3	0.0	0.0	2796770.6
39007	14	2207.8	20441.4	1354866.6	0.0	0.0	6342364.9
39327	11	2424.2	2713714.0	4930871.0	0.0	0.0	5426048.2
39648	6	3068.2	1084171.3	0.0	0.0	0.0	4910206.2
39973	9	2551.9	2439115.8	0.0	0.0	0.0	4928902.0
40382	31	2149.9	1019205.6	4007530.1	0.0	0.0	5874756.7
40796	32	2427.1	716563.4	3365336.3	0.0	0.0	4918580.2
41214	29	2413.2	2141323.3	5678811.3	0.0	0.0	7292207.2
41636	26	2420.1	1499462.6	2715963.5	0.0	0.0	4052671.8
42062	17	2419.4	584089.6	4126390.8	0.0	0.0	5476350.5
42493	20	2484.4	1260058.7	3997153.6	0.0	0.0	4159344.6
42928	17	2676.0	583035.1	3840610.5	0.0	0.0	4350603.7
43367	20	2564.3	1293150.5	5986833.9	0.0	0.0	7374842.5
43811	29	2418.3	1410588.9	3703972.4	0.0	0.0	5379321.5
44260	19	2688.5	260730.0	3674230.0	0.0	0.0	4523264.3
44531	21	2607.8	165000.1	3414116.6	0.0	0.0	5511200.6
44804	28	2584.3	698853.6	3261347.2	0.0	0.0	5572717.2
45079	38	2480.2	1042695.0	3752686.0	0.0	0.0	7165066.6
45356	20	2313.7	685809.2	3932547.2	0.0	0.0	4838159.1
45634	28	2355.8	246365.4	3670334.5	0.0	0.0	7316467.2
45913	30	2453.1	696454.4	4876041.0	0.0	0.0	6842930.7
46195	24	2462.0	1403150.2	4655616.8	0.0	0.0	7146890.4
46478	25	2749.2	791695.0	2344705.5	0.0	0.0	6146369.0
46763	16	2863.5	2508969.1	7463037.0	0.0	0.0	7604624.3
47050	19	2881.2	1844568.7	4898474.3	0.0	0.0	6854631.8
47435	42	2626.3	595720.8	4141549.0	0.0	0.0	4930581.8
47823	49	2548.8	1026513.4	4931854.8	0.0	0.0	6697796.4

48215	44	2679.8	1023618.9	4434328.5	0.0	0.0	7305266.6
48609	43	2772.9	1283348.6	3587720.5	0.0	0.0	5600321.3
49007	36	2571.2	269096.1	4011242.8	0.0	0.0	5634639.6
49408	49	2686.7	692064.1	4294280.9	0.0	0.0	5546962.8
49813	48	2861.3	972095.3	4322170.8	0.0	0.0	7176847.3
50221	32	3116.6	1319087.7	4577368.4	0.0	0.0	6424132.0
50632	42	2744.8	589089.1	4322649.3	0.0	0.0	7069506.0
51046	44	2999.1	884660.2	4272743.7	0.0	0.0	6312852.0
52097	10	2750.8	1827491.1	4933119.9	0.0	0.0	4933119.9
53169	8	3265.3	3100839.4	0.0	0.0	0.0	4908713.0
54264	8	2937.2	5168.8	0.0	0.0	0.0	1032656.4
55381	12	3199.3	650513.3	1881242.5	0.0	0.0	4742982.7
56521	8	3624.7	764154.7	0.0	0.0	0.0	2446919.1
57684	10	3279.7	113131.2	2874726.9	0.0	0.0	2874726.9
58872	9	3550.4	2011344.1	0.0	0.0	0.0	4431450.6
60084	11	3624.1	807866.8	3868533.2	0.0	0.0	4980744.8
61321	8	4004.1	3129169.7	0.0	0.0	0.0	5745690.5
62583	9	3468.2	1707118.2	0.0	0.0	0.0	7587268.5
63353	13	3780.6	429974.9	3984574.1	0.0	0.0	4051342.9
64132	11	4121.9	338147.6	3754647.2	0.0	0.0	4316006.7
64921	8	3651.4	2160564.1	0.0	0.0	0.0	5956211.5
65720	10	3652.8	270033.8	5533422.0	0.0	0.0	5533422.0
66528	14	3426.6	1637826.8	3304500.3	0.0	0.0	4159893.5
67347	18	3616.9	735281.5	4311784.9	0.0	0.0	6559706.6
68175	10	4108.6	6113.7	1583561.1	0.0	0.0	1583561.1
69014	12	3959.3	5714.2	3676033.3	0.0	0.0	4237553.9
69863	12	4033.1	881070.3	4932780.3	0.0	0.0	5175106.8
70722	9	4444.4	1799864.9	0.0	0.0	0.0	3596131.9
71156	15	3835.1	350500.1	3982164.2	0.0	0.0	7621959.2
71592	14	4509.7	1577669.3	4681108.2	0.0	0.0	7033984.2
72031	16	4463.5	1530236.0	2637294.7	0.0	0.0	3104557.5
72473	16	4547.4	101013.9	4905469.3	0.0	0.0	4917267.8
72917	11	4316.8	254811.8	2228488.0	0.0	0.0	4907020.5
73364	8	50831.8	3253309.5	0.0	0.0	0.0	4934235.7
73814	9	4666.8	594936.9	0.0	0.0	0.0	7052018.5
74266	11	4130.6	5638.1	1443455.1	0.0	0.0	2358586.7
74722	16	6200.2	1266602.7	2640317.0	0.0	0.0	3506518.6
75180	10	114270.9	1830671.2	6016368.7	0.0	0.0	6016368.7
75795	41	4105.4	1046140.1	2909646.8	0.0	0.0	4344780.2
76416	26	4367.2	1251823.9	4510512.8	0.0	0.0	6006168.1
77041	43	4431.0	270948.6	4333780.8	0.0	0.0	5396549.5
77672	30	4520.5	276651.7	3715047.6	0.0	0.0	5308686.8
78307	36	4168.7	135466.6	3930419.8	0.0	0.0	5787325.2



78948	38	4586.2	1043882.5	4541608.9	0.0	0.0	5613630.4
79595	38	4523.3	1163959.3	3845616.4	0.0	0.0	5496113.7
80246	40	4710.5	1283583.6	3824800.3	0.0	0.0	4269283.0
80903	35	4139.8	249569.1	3838810.3	0.0	0.0	5976342.7
81565	28	4524.4	721792.7	3619161.1	0.0	0.0	4125638.9
83414	23	4840.6	407842.2	3649477.5	0.0	0.0	6524787.5
85305	26	5044.6	252706.0	3427429.4	0.0	0.0	7616336.3
87238	27	5095.6	588625.2	3159599.6	0.0	0.0	4014722.5
89216	24	5551.6	1750558.1	4725704.7	0.0	0.0	5447197.9
91238	11	6707.4	528606.3	4652339.2	0.0	0.0	5195885.6
93306	23	5089.0	939428.4	4126283.3	0.0	0.0	4991286.2
95421	24	5527.1	686598.4	4268460.1	0.0	0.0	4908780.2
97584	19	6102.0	1131569.4	4126386.8	0.0	0.0	4933406.7
99796	22	6083.6	661007.2	4206118.6	0.0	0.0	7229731.7
102058	24	5877.2	833185.7	3035114.5	0.0	0.0	4879566.8
103313	13	6008.7	703987.1	3830964.5	0.0	0.0	3917501.7
104584	12	6863.2	1440675.3	4320222.7	0.0	0.0	5670874.5
105871	12	6365.6	2163887.5	3256478.9	0.0	0.0	7135175.3
107173	12	6647.1	687261.7	2432505.6	0.0	0.0	4913177.1
108492	12	6069.6	1841093.6	3759203.6	0.0	0.0	4297506.5
109826	10	7087.6	12883.4	4256663.2	0.0	0.0	4256663.2
111177	9	6231.5	8788.7	0.0	0.0	0.0	2444019.1
112545	9	6295.4	43678.2	0.0	0.0	0.0	1602677.4
113929	18	6760.1	2969971.4	4979388.2	0.0	0.0	7527782.3
115331	5	8023.9	1979252.4	0.0	0.0	0.0	3820934.1
116988	14	6073.7	811341.9	4895821.0	0.0	0.0	4937637.5
118669	17	8128.9	390200.4	3002596.6	0.0	0.0	3052981.4
120373	15	7509.3	1487653.2	4889133.3	0.0	0.0	4916419.9
122103	6	8130.4	18483.6	0.0	0.0	0.0	3222558.8
123857	13	7351.7	19862.4	4909004.0	0.0	0.0	4981342.2
125636	9	8325.8	349679.3	0.0	0.0	0.0	4647039.8
127441	9	7908.7	547264.4	0.0	0.0	0.0	2196623.7
129272	12	8088.2	337502.9	4333166.0	0.0	0.0	5600886.6
131129	17	7935.1	986150.1	4210964.0	0.0	0.0	4932167.6
133013	11	7311.0	1382360.0	4565450.7	0.0	0.0	7406695.1
135199	10	11184.9	1425944.1	4907379.2	0.0	0.0	4907379.2
137421	12	9984.0	708855.7	2709018.0	0.0	0.0	3675820.0
139679	18	8643.4	431642.5	3290923.1	0.0	0.0	3864909.6
141975	8	13094.3	2195599.1	0.0	0.0	0.0	2646775.5
144308	14	8988.8	1282836.1	3596554.5	0.0	0.0	4166573.9
146680	11	8795.4	1218296.6	4148399.5	0.0	0.0	4912225.6
149091	5	8278.9	14980.2	0.0	0.0	0.0	3544914.8
151541	13	8625.9	55150.4	4386484.3	0.0	0.0	4534837.0

154032	14	11607.6	537122.2	3167159.5	0.0	0.0	4911324.0
156563	15	10236.8	580564.9	3922881.2	0.0	0.0	4065401.2
159136	11	10460.6	1583104.4	7104034.4	0.0	0.0	7499564.9
161752	11	9401.4	28911.8	4271344.7	0.0	0.0	4480253.7
164410	9	11323.7	21030.3	0.0	0.0	0.0	2221596.3
167112	12	10052.9	1999493.5	4912445.4	0.0	0.0	4943861.8
169859	11	10147.4	261799.0	4260960.8	0.0	0.0	4527139.6
172651	10	11032.0	735779.6	5864741.0	0.0	0.0	5864741.0
175488	13	10886.8	605324.8	4252492.0	0.0	0.0	4430252.2
178373	17	13499.5	894581.6	4185374.1	0.0	0.0	4301926.5
181304	17	18208.4	2253095.4	4961427.7	0.0	0.0	6360106.6
184284	9	13375.9	24341.5	0.0	0.0	0.0	3878736.2
186932	8	15452.1	1151431.7	0.0	0.0	0.0	4248528.2
189618	11	12876.5	111498.9	3017851.3	0.0	0.0	7282203.4
192343	14	14715.4	34243.3	4241633.1	0.0	0.0	4421803.5
195107	11	12282.1	3668177.8	4971834.6	0.0	0.0	7450209.4
197911	14	14559.2	264003.8	3363502.1	0.0	0.0	3653524.8
200755	15	12697.3	1026263.5	2967684.0	0.0	0.0	7572819.2
203640	8	12608.3	696392.8	0.0	0.0	0.0	2097055.7
206566	13	15222.1	1038010.1	4308940.6	0.0	0.0	4939869.4
209535	11	12378.6	2031598.4	2650244.0	0.0	0.0	3978028.1
212546	7	23177.5	3264782.1	0.0	0.0	0.0	6206191.6
215160	9	14038.0	815245.1	0.0	0.0	0.0	4313198.2
217805	7	16908.5	1326464.2	0.0	0.0	0.0	2519938.1
220484	16	15165.0	1517788.0	4522420.0	0.0	0.0	7241335.0
223195	8	14202.6	1939916.7	0.0	0.0	0.0	5165621.4
225940	13	14047.1	1364427.3	4559239.8	0.0	0.0	5676601.9
228718	9	18028.2	427621.2	0.0	0.0	0.0	5940013.2
231530	11	20009.7	1944608.7	3080325.2	0.0	0.0	3148552.0
234377	9	14719.8	1274976.1	0.0	0.0	0.0	2207414.4
237259	11	20043.6	2425773.0	4830706.0	0.0	0.0	5767509.6
240177	9	29348.8	2249170.6	0.0	0.0	0.0	4584867.2
244622	15	16146.4	1813624.8	4694480.8	0.0	0.0	4917889.3
249150	13	21880.2	933861.7	6411259.2	0.0	0.0	6479763.8
253761	15	15070.4	43006.2	3254923.3	0.0	0.0	3306439.0
258458	10	17936.5	2250342.6	4182245.7	0.0	0.0	4182245.7
263241	17	18308.5	40184.2	4185590.8	0.0	0.0	5134730.5
268113	12	21981.2	1021798.0	2199934.2	0.0	0.0	2335293.8
273075	5	28417.0	40790.7	0.0	0.0	0.0	2162583.9
278129	5	29226.0	1353037.4	0.0	0.0	0.0	2004907.6
283277	14	17939.9	829883.1	2876345.7	0.0	0.0	6930233.8
288520	11	33538.8	2458012.5	3779975.5	0.0	0.0	3929725.8
302981	11	29830.1	2140936.8	3554809.8	0.0	0.0	4930822.0

318166	11	20897.2	2777201.6	4644680.2	0.0	0.0	7019517.5
334113	10	20880.4	2512624.2	4948550.7	0.0	0.0	4948550.7
350858	21	25685.9	2617904.9	3800376.0	0.0	0.0	4943666.9
368444	5	36751.9	1117528.4	0.0	0.0	0.0	3815102.0
386910	10	30307.6	1989425.8	6341289.6	0.0	0.0	6341289.6
406302	17	34089.8	582584.0	4598133.9	0.0	0.0	4946674.5
426666	9	34264.8	1344588.6	0.0	0.0	0.0	4092023.6
448051	12	64727.8	2233306.4	3719468.3	0.0	0.0	3866501.9
470507	15	51372.4	3027707.6	4432307.2	0.0	0.0	5843576.8
492079	14	41809.2	1795845.8	4454971.8	0.0	0.0	4611847.9
514641	4	39428.6	971939.9	0.0	0.0	0.0	1063283.5
538237	4	951104.8	4481294.4	0.0	0.0	0.0	5108654.2
562914	5	65177.7	2439422.4	0.0	0.0	0.0	4122934.9
588723	1	4564568.5	4564568.5	0.0	0.0	0.0	4564568.5
615716	16	61044.8	2291271.4	3907725.4	0.0	0.0	4214461.1
643946	6	143104.1	182792.7	0.0	0.0	0.0	1334491.6
673470	5	100739.1	1047803.4	0.0	0.0	0.0	3064883.0
704348	8	116273.2	2359931.8	0.0	0.0	0.0	3968473.9
736642	2	1634302.2	4382699.4	0.0	0.0	0.0	4382699.4
754877	4	186735.0	2763877.8	0.0	0.0	0.0	4271953.7
773563	6	113068.6	646553.7	0.0	0.0	0.0	4544185.7
792711	3	405085.0	1432486.4	0.0	0.0	0.0	4670444.7
812333	3	263184.4	2630075.2	0.0	0.0	0.0	2691451.0
832442	5	82898.8	201234.5	0.0	0.0	0.0	3986905.5
853048	6	182269.5	893914.9	0.0	0.0	0.0	5644135.8
874164	4	187932.3	4056744.0	0.0	0.0	0.0	4310443.1
895802	8	143795.9	4315549.4	0.0	0.0	0.0	7412420.3
917977	7	216469.5	1107001.7	0.0	0.0	0.0	6221001.0
940700	3	281386.2	539160.2	0.0	0.0	0.0	4516987.1
1002039	12	103295.1	4054253.9	6516094.0	0.0	0.0	6602492.6
1067379	11	215421.2	1201973.8	7001713.8	0.0	0.0	7005274.7
1136978	15	270547.5	1200489.4	3431179.0	0.0	0.0	4244960.0
1211116	10	226360.4	1699897.7	6917216.2	0.0	0.0	6917216.2
1290088	16	238380.3	1617067.8	8147159.5	0.0	0.0	8326212.6
1374210	8	651697.9	3983928.8	0.0	0.0	0.0	8302762.8
1463817	12	150409.5	2866341.7	9550314.6	0.0	0.0	9710881.1
1559267	9	542803.9	2264681.7	0.0	0.0	0.0	4885452.7
1660940	12	715202.8	1932469.2	3780632.5	0.0	0.0	4302376.6
1769244	5	1518495.6	1722894.1	0.0	0.0	0.0	2097600.5
1805665	4	2022101.6	2737560.2	0.0	0.0	0.0	2821656.3
1842837	2	2279524.8	2916472.3	0.0	0.0	0.0	2916472.3
1880773	6	1346624.6	2021381.4	0.0	0.0	0.0	3968772.6
1919490	8	1485303.3	2310608.2	0.0	0.0	0.0	3373893.4

1959005	4	1764417.2	2941976.2	0.0	0.0	0.0	3254339.7
1999332	7	1869838.7	3539696.9	0.0	0.0	0.0	4289495.4
2040490	7	1157566.0	2007077.7	0.0	0.0	0.0	3445185.9
2082496	9	2196270.8	3192884.2	0.0	0.0	0.0	4114372.3
2125366	9	2220794.8	4784099.1	0.0	0.0	0.0	5669059.4
2169118	4	2299807.3	3683531.1	0.0	0.0	0.0	4986641.2
2527289	15	3180507.0	4996626.2	6109294.5	0.0	0.0	6686901.1
2944602	15	4633030.7	5051615.3	7510935.5	0.0	0.0	8041039.4
3430822	4	7440840.2	8502212.5	0.0	0.0	0.0	9415782.7

\*\*\*\* client1.homa2.log:

1525291241.678573958 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.007, expecting 0.100, throttled 0.078

\*\*\*\* client3.homa4.log:

1525291241.381947802 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.027, expecting 0.100, throttled 0.050

\*\*\*\* client2.homa3.log:

1525291241.395714286 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.027, expecting 0.100, throttled 0.046

## Homa+Udp : W5 load

```
homa@homa1:~/platformlab/RAMCloud$ scripts/clusterperf.py --transport homa+udp -r 0
--clients 3 --servers 1 --messageSizeCDF benchmarks/homa/messageSizeCDFs/W5.txt
--targetTput 1.0 echo_workload
```

```
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa2,10.145.94.43' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa3,10.145.94.53' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa1,10.145.94.33' (ECDSA) to the list of known hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known hosts.
# Generated by 'clusterperf.py echoWorkload'
#
```

```
# Size Samples    Min  Median    90%    99%    99.9%    Max
#-----
```

1470	26	160.9	397.6	1438839.5	0.0	0.0	4534246.9
2940	30	288.0	455.5	2431531.3	0.0	0.0	5369602.8
4410	29	270.9	446.9	518898.1	0.0	0.0	2450531.3
5880	22	317.9	420.6	1463.1	0.0	0.0	1457861.7
7350	21	336.6	492.0	960353.4	0.0	0.0	4553275.6
8820	25	405.6	557.8	2622.6	0.0	0.0	588518.6
10290	8	380.3	614.2	0.0	0.0	0.0	2439328.0
11760	9	769.8	1137.8	0.0	0.0	0.0	1711218.2
13230	5	883.8	4767.1	0.0	0.0	0.0	2830211.8
14700	7	1153.8	6616.5	0.0	0.0	0.0	4958710.5
16170	11	935.0	1201.0	267728.3	0.0	0.0	461733.8
17640	8	1010.1	1309.4	0.0	0.0	0.0	5757.2
19110	8	1011.8	1370.6	0.0	0.0	0.0	924246.5
20580	11	1091.8	1292.7	6753.8	0.0	0.0	2505510.6
22050	9	1406.6	947673.6	0.0	0.0	0.0	2846042.2
23520	19	1241.3	7510.8	1751745.4	0.0	0.0	2420650.3
24990	14	1431.4	8636.6	1739431.9	0.0	0.0	4129139.6
26460	20	1544.2	2037.1	1129834.2	0.0	0.0	1725264.6
27930	14	1490.7	2411.2	8499.9	0.0	0.0	1433043.6
29400	12	1647.1	8223.9	1554065.6	0.0	0.0	1726469.5
30870	5	2081.0	2200.0	0.0	0.0	0.0	2494122.1
32340	8	1730.5	2327.6	0.0	0.0	0.0	9501.5
33810	5	1873.7	2268.4	0.0	0.0	0.0	1700711.1
35280	11	2057.6	2477.2	1709493.1	0.0	0.0	2402074.5
36750	7	2181.7	2614.4	0.0	0.0	0.0	838371.5
38220	12	2117.7	2365.7	10521.5	0.0	0.0	509440.5
39690	6	2405.4	3009.2	0.0	0.0	0.0	10410.8
41160	13	2283.3	2689.4	11234.8	0.0	0.0	11263.0
42630	11	2454.9	2644.6	685351.7	0.0	0.0	1822458.6
44100	6	2494.1	3303.2	0.0	0.0	0.0	2384441.5
45570	9	2511.7	2993.7	0.0	0.0	0.0	1719054.9
47040	6	2827.1	1006111.5	0.0	0.0	0.0	4800831.3
48510	10	2590.6	3207.9	1718945.0	0.0	0.0	1718945.0
49980	6	3000.2	3206.1	0.0	0.0	0.0	3295.8
51450	10	2868.4	3246.7	5362904.8	0.0	0.0	5362904.8
52920	13	2995.4	3411.6	1072030.1	0.0	0.0	2478485.0
54390	3	3054.9	3323.9	0.0	0.0	0.0	1783189.4
55860	4	3161.5	3457.6	0.0	0.0	0.0	3518.6
57330	10	3343.2	4137.9	702827.8	0.0	0.0	702827.8
58800	4	3835.4	1683240.4	0.0	0.0	0.0	1764326.3
60270	7	3673.2	3749.3	0.0	0.0	0.0	16731.8
61740	11	3367.9	3913.7	1917571.8	0.0	0.0	2488627.5
63210	2	3840.7	4041.8	0.0	0.0	0.0	4041.8

64680	8	3874.2	4252.5	0.0	0.0	0.0	22503.3
66150	7	3568.9	4459.0	0.0	0.0	0.0	18990.9
67620	10	3812.1	4674.0	1737405.8	0.0	0.0	1737405.8
69090	5	3908.6	4055.8	0.0	0.0	0.0	6102.9
70560	2	4317.4	17591.7	0.0	0.0	0.0	17591.7
72030	7	3912.1	4821.9	0.0	0.0	0.0	1769423.1
73500	7	4270.6	4637.8	0.0	0.0	0.0	17815.3
74970	6	4505.8	4762.2	0.0	0.0	0.0	305427.2
76440	11	4246.7	7302.8	529391.7	0.0	0.0	3448673.7
77910	8	4467.1	21230.5	0.0	0.0	0.0	3451403.7
79380	1	5984.1	5984.1	0.0	0.0	0.0	5984.1
82320	1	5078.8	5078.8	0.0	0.0	0.0	5078.8
83790	3	4742.4	4819.2	0.0	0.0	0.0	5316.8
85260	1	5525.3	5525.3	0.0	0.0	0.0	5525.3
88200	3	6163.0	20310.1	0.0	0.0	0.0	546728.3
89670	1	5124.8	5124.8	0.0	0.0	0.0	5124.8
94080	1	5628.0	5628.0	0.0	0.0	0.0	5628.0
97020	1	6074.7	6074.7	0.0	0.0	0.0	6074.7
98490	1	5526.9	5526.9	0.0	0.0	0.0	5526.9
101430	2	25053.4	25324.5	0.0	0.0	0.0	25324.5
102900	1	6713.7	6713.7	0.0	0.0	0.0	6713.7
104370	1	6681.1	6681.1	0.0	0.0	0.0	6681.1
111720	3	6689.8	8912.3	0.0	0.0	0.0	33023.9
113190	1	107984.7	107984.7	0.0	0.0	0.0	107984.7
114660	1	446793.1	446793.1	0.0	0.0	0.0	446793.1
117600	1	1420162.2	1420162.2	0.0	0.0	0.0	1420162.2
119070	2	6789.1	1127203.1	0.0	0.0	0.0	1127203.1
120540	2	6225.3	8433.9	0.0	0.0	0.0	8433.9
122010	1	6860.1	6860.1	0.0	0.0	0.0	6860.1
124950	2	7368.7	7480.2	0.0	0.0	0.0	7480.2
126420	1	7772.7	7772.7	0.0	0.0	0.0	7772.7
127890	1	7394.2	7394.2	0.0	0.0	0.0	7394.2
129360	1	29232.7	29232.7	0.0	0.0	0.0	29232.7
133770	1	8070.7	8070.7	0.0	0.0	0.0	8070.7
135240	1	7431.2	7431.2	0.0	0.0	0.0	7431.2
136710	1	34467.9	34467.9	0.0	0.0	0.0	34467.9
141120	1	8875.3	8875.3	0.0	0.0	0.0	8875.3
142590	3	8474.5	10447.8	0.0	0.0	0.0	257061.3
145530	3	7958.4	32817.5	0.0	0.0	0.0	1486109.9
147000	1	8457.5	8457.5	0.0	0.0	0.0	8457.5
148470	1	9577.4	9577.4	0.0	0.0	0.0	9577.4
152880	1	447272.5	447272.5	0.0	0.0	0.0	447272.5
157290	1	9045.2	9045.2	0.0	0.0	0.0	9045.2

160230	1	8978.8	8978.8	0.0	0.0	0.0	8978.8
161700	1	347039.1	347039.1	0.0	0.0	0.0	347039.1
163170	1	38028.6	38028.6	0.0	0.0	0.0	38028.6
164640	3	10238.3	11178.0	0.0	0.0	0.0	937218.8
169050	1	77430.1	77430.1	0.0	0.0	0.0	77430.1
173460	2	9975.8	11760.7	0.0	0.0	0.0	11760.7
180810	1	14714.3	14714.3	0.0	0.0	0.0	14714.3
182280	1	21083.7	21083.7	0.0	0.0	0.0	21083.7
183750	1	10922.8	10922.8	0.0	0.0	0.0	10922.8
186690	1	10614.7	10614.7	0.0	0.0	0.0	10614.7
188160	1	1813023.9	1813023.9	0.0	0.0	0.0	1813023.9
191100	1	11967.8	11967.8	0.0	0.0	0.0	11967.8
192570	1	13754.7	13754.7	0.0	0.0	0.0	13754.7
194040	1	11528.1	11528.1	0.0	0.0	0.0	11528.1
196980	1	1789210.9	1789210.9	0.0	0.0	0.0	1789210.9
205800	1	46863.3	46863.3	0.0	0.0	0.0	46863.3
207270	2	11504.3	2714831.8	0.0	0.0	0.0	2714831.8
224910	1	3716573.5	3716573.5	0.0	0.0	0.0	3716573.5
229320	1	14313.3	14313.3	0.0	0.0	0.0	14313.3
230790	1	13547.3	13547.3	0.0	0.0	0.0	13547.3
235200	1	13343.1	13343.1	0.0	0.0	0.0	13343.1
241080	1	14278.5	14278.5	0.0	0.0	0.0	14278.5
242550	1	14988.6	14988.6	0.0	0.0	0.0	14988.6
251370	1	14887.4	14887.4	0.0	0.0	0.0	14887.4
258720	1	13617.0	13617.0	0.0	0.0	0.0	13617.0
270480	1	16117.9	16117.9	0.0	0.0	0.0	16117.9
291060	1	18358.1	18358.1	0.0	0.0	0.0	18358.1
292530	1	18005.0	18005.0	0.0	0.0	0.0	18005.0
305760	1	17427.8	17427.8	0.0	0.0	0.0	17427.8
333690	1	97266.7	97266.7	0.0	0.0	0.0	97266.7
335160	1	101586.9	101586.9	0.0	0.0	0.0	101586.9
338100	2	24253.9	66445.4	0.0	0.0	0.0	66445.4
341040	1	28252.5	28252.5	0.0	0.0	0.0	28252.5
343980	2	19098.2	20196.5	0.0	0.0	0.0	20196.5
351330	1	30013.3	30013.3	0.0	0.0	0.0	30013.3
392490	4	23183.6	97475.7	0.0	0.0	0.0	111181.1
411600	3	33473.9	38841.0	0.0	0.0	0.0	102009.1
432180	4	24541.8	32878.7	0.0	0.0	0.0	4010278.3
451290	2	27374.0	27428.7	0.0	0.0	0.0	27428.7
470400	2	36386.2	55593.7	0.0	0.0	0.0	55593.7
490980	3	132204.9	140838.9	0.0	0.0	0.0	557777.4
510090	1	550748.1	550748.1	0.0	0.0	0.0	550748.1
529200	3	30937.6	58997.8	0.0	0.0	0.0	2248581.0

549780	3	33655.5	34392.6	0.0	0.0	0.0	135395.5
568890	1	34438.9	34438.9	0.0	0.0	0.0	34438.9
588000	1	702492.4	702492.4	0.0	0.0	0.0	702492.4
608580	5	38258.6	43523.3	0.0	0.0	0.0	2495866.1
627690	4	34571.3	35207.3	0.0	0.0	0.0	49816.3
648270	1	104870.5	104870.5	0.0	0.0	0.0	104870.5
667380	2	45383.8	45543.1	0.0	0.0	0.0	45543.1
686490	2	60049.3	201197.2	0.0	0.0	0.0	201197.2
707070	2	55939.0	234448.0	0.0	0.0	0.0	234448.0
745290	1	44030.8	44030.8	0.0	0.0	0.0	44030.8
765870	1	109328.7	109328.7	0.0	0.0	0.0	109328.7
784980	4	49698.9	224428.5	0.0	0.0	0.0	1860679.7
804090	2	61236.0	2880241.2	0.0	0.0	0.0	2880241.2
824670	2	49516.6	58939.3	0.0	0.0	0.0	58939.3
843780	2	51305.7	242144.2	0.0	0.0	0.0	242144.2
862890	5	52408.6	77359.8	0.0	0.0	0.0	309401.0
883470	1	398656.2	398656.2	0.0	0.0	0.0	398656.2
902580	1	344603.5	344603.5	0.0	0.0	0.0	344603.5
921690	2	56257.3	372109.9	0.0	0.0	0.0	372109.9
942270	2	64532.1	87349.3	0.0	0.0	0.0	87349.3
961380	2	87708.0	1852412.9	0.0	0.0	0.0	1852412.9
980490	3	64268.0	858123.6	0.0	0.0	0.0	975913.9
1005480	3	92019.0	789453.5	0.0	0.0	0.0	2819560.3
1030470	4	60176.0	87777.1	0.0	0.0	0.0	5148638.8
1053990	3	75159.9	76017.2	0.0	0.0	0.0	2646276.4
1103970	3	66424.0	79186.3	0.0	0.0	0.0	97492.8
1127490	4	75145.8	110255.2	0.0	0.0	0.0	3934462.9
1152480	4	69672.8	651570.5	0.0	0.0	0.0	1451794.5
1177470	4	81995.5	94510.8	0.0	0.0	0.0	141860.0
1200990	1	114533.7	114533.7	0.0	0.0	0.0	114533.7
1225980	2	585519.8	1379531.1	0.0	0.0	0.0	1379531.1
1250970	2	96195.7	96885.8	0.0	0.0	0.0	96885.8
1274490	2	74045.1	4371938.4	0.0	0.0	0.0	4371938.4
1299480	5	80250.2	90619.3	0.0	0.0	0.0	2352396.9
1324470	2	116224.7	126147.1	0.0	0.0	0.0	126147.1
1347990	2	80263.5	83841.9	0.0	0.0	0.0	83841.9
1372980	1	84254.8	84254.8	0.0	0.0	0.0	84254.8
1397970	3	123835.8	740748.4	0.0	0.0	0.0	4808664.2
1421490	5	87322.6	159249.5	0.0	0.0	0.0	2539932.0
1446480	3	128182.9	138797.3	0.0	0.0	0.0	879581.7
1470000	2	95064.6	1715224.4	0.0	0.0	0.0	1715224.4
1494990	2	93620.1	112759.0	0.0	0.0	0.0	112759.0
1519980	1	812947.2	812947.2	0.0	0.0	0.0	812947.2



1543500	4	94090.4	953662.3	0.0	0.0	0.0	1263411.9
1568490	4	97768.9	142080.4	0.0	0.0	0.0	176875.9
1593480	1	106731.7	106731.7	0.0	0.0	0.0	106731.7
1617000	2	1169496.7	1752457.9	0.0	0.0	0.0	1752457.9
1641990	4	111502.8	194422.6	0.0	0.0	0.0	2682791.6
1666980	2	113332.0	143602.1	0.0	0.0	0.0	143602.1
1690500	4	108648.4	138754.1	0.0	0.0	0.0	1158309.5
1715490	7	101056.6	145688.6	0.0	0.0	0.0	2884184.1
1740480	5	108898.6	197147.4	0.0	0.0	0.0	5343126.6
1764000	4	161098.7	244829.3	0.0	0.0	0.0	3886383.5
1788990	1	2478294.1	2478294.1	0.0	0.0	0.0	2478294.1
1813980	3	110551.2	161593.1	0.0	0.0	0.0	198221.1
1837500	3	117468.0	218476.0	0.0	0.0	0.0	1710187.5
1862490	3	115648.8	148803.4	0.0	0.0	0.0	164591.6
1887480	2	143333.4	1683073.8	0.0	0.0	0.0	1683073.8
1911000	4	117324.8	134712.4	0.0	0.0	0.0	557437.3
1935990	3	118376.7	131115.1	0.0	0.0	0.0	162845.0
1959510	1	136819.7	136819.7	0.0	0.0	0.0	136819.7
2033010	2	150739.9	281322.0	0.0	0.0	0.0	281322.0
2106510	2	193908.4	205016.0	0.0	0.0	0.0	205016.0
2180010	4	143403.6	1030041.9	0.0	0.0	0.0	5486008.2
2253510	2	193776.5	250716.9	0.0	0.0	0.0	250716.9
2327010	2	156712.3	542473.4	0.0	0.0	0.0	542473.4
2400510	3	175100.4	220554.4	0.0	0.0	0.0	317327.8
2474010	5	218341.6	325918.9	0.0	0.0	0.0	383587.4
2547510	4	264838.8	3745511.8	0.0	0.0	0.0	6556318.1
2694510	6	226600.2	543190.3	0.0	0.0	0.0	3855236.2
2768010	5	174214.4	261284.4	0.0	0.0	0.0	299751.2
2915010	2	232003.7	362947.2	0.0	0.0	0.0	362947.2
2988510	2	283641.9	408627.7	0.0	0.0	0.0	408627.7
3062010	2	415810.9	719569.4	0.0	0.0	0.0	719569.4
3135510	3	308777.8	5138337.7	0.0	0.0	0.0	5463586.5
3209010	2	370909.2	387326.9	0.0	0.0	0.0	387326.9
3282510	5	345358.0	421191.1	0.0	0.0	0.0	6255421.2
3356010	3	342513.3	8141919.5	0.0	0.0	0.0	8461519.2
3429510	3	625507.4	803987.6	0.0	0.0	0.0	928391.9
3503010	2	422312.6	10437083.9	0.0	0.0	0.0	10437083.9
3576510	3	324804.2	578565.8	0.0	0.0	0.0	1398367.7
3650010	5	348884.3	506554.0	0.0	0.0	0.0	7074005.6
3723510	1	413047.2	413047.2	0.0	0.0	0.0	413047.2
3797010	2	291325.3	377375.0	0.0	0.0	0.0	377375.0
3870510	2	304676.1	364760.7	0.0	0.0	0.0	364760.7
3944010	3	341029.0	581730.7	0.0	0.0	0.0	791555.2

4017510	3	331851.9	401530.8	0.0	0.0	0.0	899827.6
4091010	1	381904.0	381904.0	0.0	0.0	0.0	381904.0
4164510	2	410690.2	597755.3	0.0	0.0	0.0	597755.3
4311510	3	469939.6	480566.0	0.0	0.0	0.0	736537.9
4385010	2	963027.6	1419606.1	0.0	0.0	0.0	1419606.1
4458510	3	298449.1	898623.2	0.0	0.0	0.0	1322378.2
4532010	5	722031.6	1132504.6	0.0	0.0	0.0	1879776.3
4605510	4	1279846.7	2174507.7	0.0	0.0	0.0	4965954.2
4679010	2	618234.8	2666732.4	0.0	0.0	0.0	2666732.4
4752510	6	313751.5	1899017.4	0.0	0.0	0.0	2127181.8
4826010	1	1970548.9	1970548.9	0.0	0.0	0.0	1970548.9
4899510	3	1153047.1	1703134.2	0.0	0.0	0.0	2106844.2
10291470	4	1135745.9	4013155.0	0.0	0.0	0.0	5710346.9
10780980	1	6571411.2	6571411.2	0.0	0.0	0.0	6571411.2
11270490	2	2645485.7	4255405.9	0.0	0.0	0.0	4255405.9
11761470	3	2215287.7	10300253.6	0.0	0.0	0.0	10750998.1

\*\*\*\* client1.homa2.log:

1525291358.683119930 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.008, expecting 0.100, throttled 0.055

\*\*\*\* client3.homa4.log:

1525291358.375577466 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.026, expecting 0.100, throttled 0.024

\*\*\*\* client2.homa3.log:

1525291358.376155057 ClusterPerf.cc:1444 in echoMessageAsync ERROR[1]: Actual load factor 0.026, expecting 0.100, throttled 0.006

## Troubleshooting tips:

### Issue 1: Ulimit:

```
machine2@machine2-VirtualBox:~/RAMCloud$ ./obj/coordinator
1524010398.009366564 CoordinatorMain.cc:96 in main NOTICE[1]: Command line:
./obj/coordinator
1524010398.009411988 CoordinatorMain.cc:97 in main NOTICE[1]: Coordinator
process id: 2403
1524010398.013366073 Common.cc:221 in pinAllMemory WARNING[1]: Could not lock
all memory pages (Cannot allocate memory), so the OS might swap memory later.
```

Check your user's "ulimit -l" and adjust /etc/security/limits.conf as necessary.

```
1524010398.013611881 TransportManager.cc:587 in dumpTransportFactories
NOTICE[1]: Known transports: kernelTcp (tcp), basic+kernelUdp (basic+udp),
homa+kernelUdp (homa+udp)
1524010398.014763563 CoordinatorMain.cc:153 in main ERROR[1]: Fatal error in
coordinator at fast+udp:host=0.0.0.0,port=12246: RAMCloud::Exception: Servers
must listen on at least one service locator, but no possible transports were
found for 'fast+udp:host=0.0.0.0,port=12246', thrown at
TransportManager::initialize at src/TransportManager.cc:317
```

## Resolution

Change following file /etc/security/limits.conf

Username here is machine2 or homa

```
@machine2    -      memlock      unlimited
@homa        -      memlock unlimited
```

## Issue 2: Sudo issue

What is sudo doesn't exist ?

## Resolution

Install sudo package with root privileges

```
apt-get install sudo
```

## Issue 3: Image Privileges

## Resolution

Make sure your machine starts with privileged mode for changing any sys level parameters

## Issue 4: Compilation FPIC error

can not be used when making a shared object; recompile with "fPIC" : error  
adding symbols: Bad value

## Resolution

From dpdk/x86\_64-native-linuxapp-gcc directory  
 Ran following command  
`./configure CFLAGS=-fPIC; make`

Then from platformlab/RAMCloud/  
 Run following command  
`HOMA_BENCHMARK=yes make all`

## Issue 5: Shared Compilation FPIC error

```
homa@homa1:~/platformlab/RAMCloud$ scripts/clusterperf.py --transport
basic+dpdk --dpdkPort 0 -r 0 --superuser echo_basic
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known
hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known
hosts.
/home/homa/platformlab/RAMCloud/obj.homa_branch_with_changes/coordinator: error
while loading shared libraries: librte_ethdev.so.9.1: cannot open shared object
file: No such file or directory
/home/homa/platformlab/RAMCloud/obj.homa_branch_with_changes/apps/ensureServers
: error while loading shared libraries: librte_ethdev.so.9.1: cannot open
shared object file: No such file or directory
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known
hosts.
Warning: Permanently added 'homa4,10.145.94.63' (ECDSA) to the list of known
hosts.
Traceback (most recent call last):
  File "scripts/clusterperf.py", line 1101, in <module>
    run_test(test, options)
  File "scripts/clusterperf.py", line 384, in run_test
    test.function(test.name, options, cluster_args, client_args)
  File "scripts/clusterperf.py", line 434, in echo
    default(name, options, cluster_args, client_args)
  File "scripts/clusterperf.py", line 411, in default
    flatten_args(client_args), name), **cluster_args)
  File "/home/homa/platformlab/RAMCloud/scripts/cluster.py", line 652, in run
    cluster.start_coordinator(coordinator_host, coordinator_args)
  File "/home/homa/platformlab/RAMCloud/scripts/cluster.py", line 299, in
start_coordinator
    self.ensure_servers(0, 0)
```

```

File "/home/homa/platformlab/RAMCloud/scripts/cluster.py", line 441, in
ensure_servers
    self.sandbox.rsh(self.coordinator_host[0], ensureCommand)
File "/home/homa/platformlab/RAMCloud/scripts/common.py", line 126, in rsh
    subprocess.check_call(sh_command, **kwargs)
File "/usr/lib/python2.7/subprocess.py", line 541, in check_call
    raise CalledProcessError(retcode, cmd)
subprocess.CalledProcessError: Command '['ssh', 'homa4', 'sudo',
'/home/homa/platformlab/RAMCloud/scripts/remoteexec.py', ''
/home/homa/platformlab/RAMCloud/obj.homa_branch_with_changes/apps/ensureServers
-C basic+udp:host=10.145.94.63,port=12246 -m 0 -b 0 -l 1 --wait 30 --logFile
logs/20180503110543/ensureServers.log"', '/home/homa/platformlab/RAMCloud']'
returned non-zero exit status 127
homa@homa1:~/platformlab/RAMCloud$

```

### Resolution:

```

Compiling dpdk on all machines
From dpdk/x86_64-native-linuxapp-gcc    directory
Run following command
./configure CFLAGS=-fPIC; make

```

### Issue 6: HugePages info

```

homa@homa1:~/platformlab/RAMCloud/logs/latest$ cat coordinator.homa4.log
1525371811.908166956 CoordinatorMain.cc:96 in main NOTICE[1]: Command line:
/home/homa/platformlab/RAMCloud/obj.homa_branch_with_changes/coordinator -C
basic+udp:host=10.145.94.63,port=12246 -l NOTICE --logFile
logs/20180503112331/coordinator.homa4.log --dpdkPort 0 --configDir config
1525371811.908190647 CoordinatorMain.cc:97 in main NOTICE[1]: Coordinator
process id: 2729
1525371811.908257797 DpdkDriver.cc:146 in DpdkDriver NOTICE[1]: Using DPDK
version DPDK 18.05.0-rc0
1525371811.911372895 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Detected
32 lcore(s)
1525371811.911395505 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Detected
4 NUMA nodes
1525371811.911592940 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL:
Multi-process socket /var/run/.homa4_unix
1525371811.912717295 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: No free
hugepages reported in hugepages-1048576kB
1525371811.913162741 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Probing
VFIO support...

```

```
1525371812.023396593 CoordinatorMain.cc:153 in main ERROR[1]: Fatal error in
coordinator at ???: RAMCloud::DriverException: Failed to allocate memory for
packet buffers: No such file or directory, thrown at DpdkDriver at
src/DpdkDriver.cc:172
```

### Resolution (reference solution to redhat)

[https://access.redhat.com/documentation/en-us/red\\_hat\\_enterprise\\_linux/6/html/virtualization\\_tuning\\_and\\_optimization\\_guide/sect-Virtualization\\_Tuning\\_Optimization\\_Guide-Memory-Huge\\_Pages-1GB-runtime](https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/6/html/virtualization_tuning_and_optimization_guide/sect-Virtualization_Tuning_Optimization_Guide-Memory-Huge_Pages-1GB-runtime)

```
# mkdir /dev/hugepages1G
# mount -t hugetlbfs -o pagesize=1G none /dev/hugepages1G
# systemctl restart libvirtd
```

### Issue 7: No free pages

```
DPDK: EAL: No free hugepages reported in hugepages-1048576kB
```

### Resolution:

```
echo 4 | sudo tee /sys/kernel/mm/hugepages/hugepages-1048576kB/nr_hugepages
```

### Issue 8: rte\_service\_init() failed

```
DPDK: EAL: FATAL: rte_service_init() failed error allocating rte services
array
```

```
homa@homa2:~/platformlab/RAMCloud/logs/latest$ cat coordinator.homa4.log
1525459212.185781925 CoordinatorMain.cc:96 in main NOTICE[1]: Command line:
/home/homa/platformlab/RAMCloud/obj.homa_branch_with_changes/coordinator -C
basic+udp:host=10.145.94.33,port=12246 -l NOTICE --logFile
logs/20180504114011/coordinator.homa4.log --dpdkPort 0 --configDir config
1525459212.185809659 CoordinatorMain.cc:97 in main NOTICE[1]: Coordinator
process id: 27123
1525459212.185895469 DpdkDriver.cc:146 in DpdkDriver NOTICE[1]: Using DPDK
version DPDK 18.05.0-rc0
1525459212.189995217 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Detected
32 lcore(s)
1525459212.190016116 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Detected
4 NUMA nodes
1525459212.190255862 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL:
Multi-process socket /home/homa/.homa4_unix
```

```

1525459212.191613561 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: 4
hugepages of size 1073741824 reserved, but no mounted hugetlbfs found for that
size
1525459212.192090760 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Probing
VFIO support...
1525459212.199060909 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL: Cannot
obtain physical addresses: No such file or directory. Only vfio will function.
1525459212.303281779 FileLogger.cc:100 in write NOTICE[1]: DPDK: EAL:
rte_service_init() failed
1525459212.303299817 FileLogger.cc:100 in write NOTICE[1]: DPDK:
1525459212.303565887 CoordinatorMain.cc:153 in main ERROR[1]: Fatal error in
coordinator at ???: RAMCloud::DriverException: rte_eal_init failed,

```

### Resolution (Partial):

```

sudo chown -R $USER: /sys/class/uio/uio0/device/
sudo chown -R $USER: /dev
sudo chown -R $USER: /mnt/huge
sudo chown -R $USER: /sys/devices/system/node/

sudo chmod u+w /sys/class/
sudo chmod u+w /dev
sudo chmod u+w /mnt/huge
sudo chmod u+w /sys/devices/system/node/

```

## Questions

### Number of samples

The number of samples are low in most of the W3/W4/W5 work loads.

Because of low number of samples the graph says zero value for 90% and 99% percentile.

### Network Load

How did they implement variation of the network load and how is it measured

### Dpdk initialization issues

How did they let dpdk initialized for coordinator/server/client to run

