

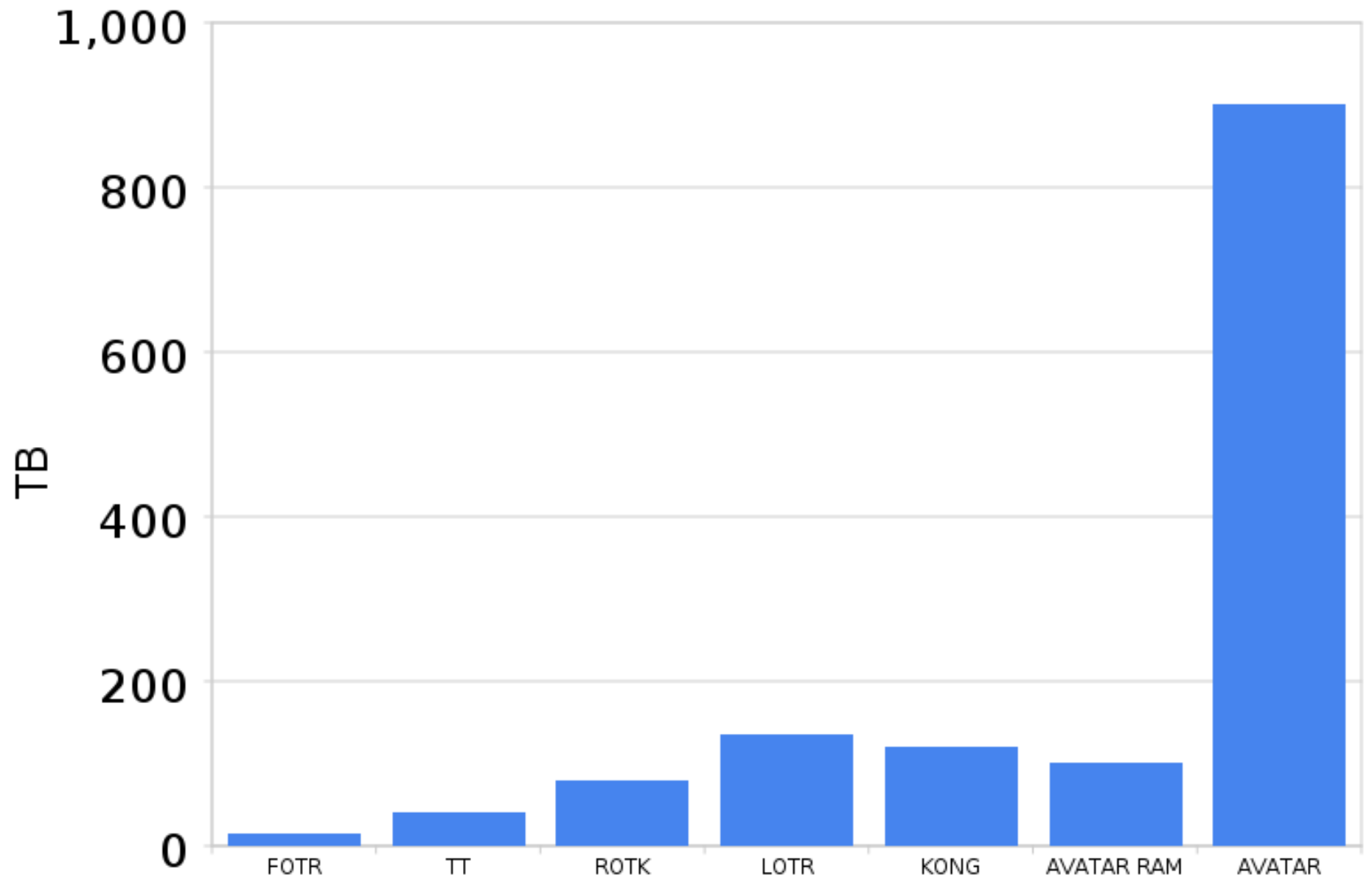
# Storage Performance Management at Weta Digital

Matt Provost



[flickr.com/photos/mikex](https://www.flickr.com/photos/mikex)

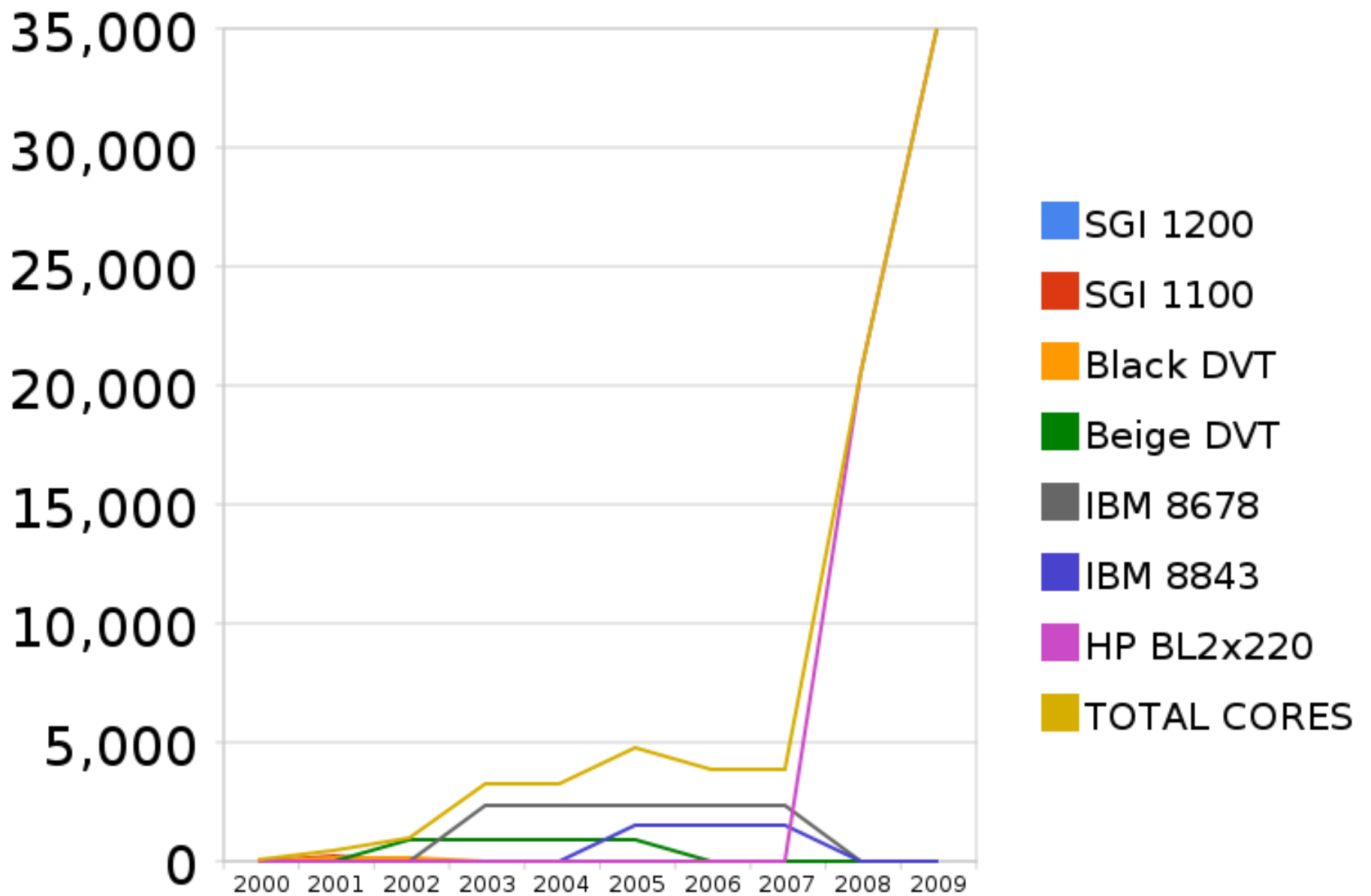
# Disk Usage per Film





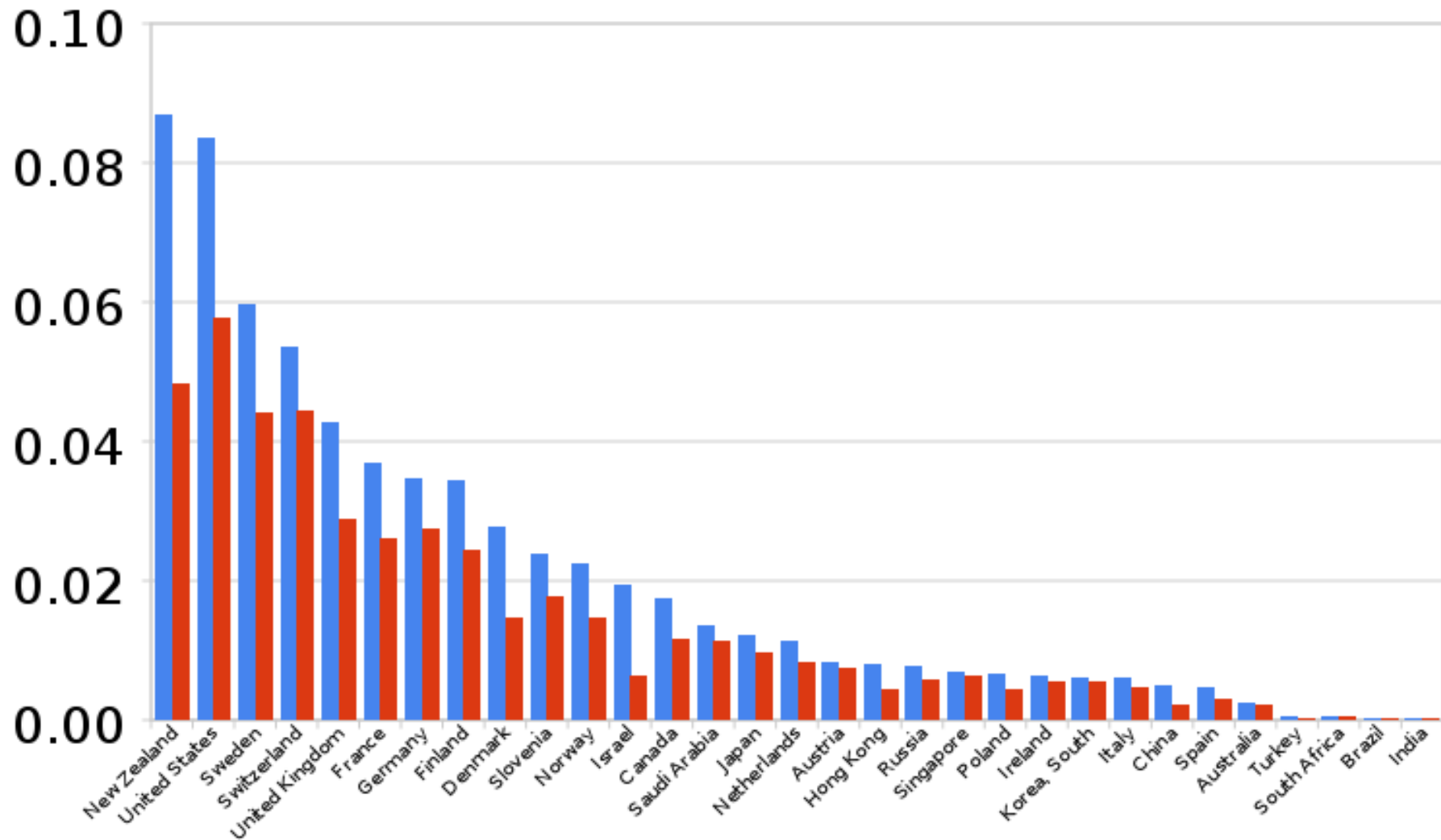


# Renderwall cores

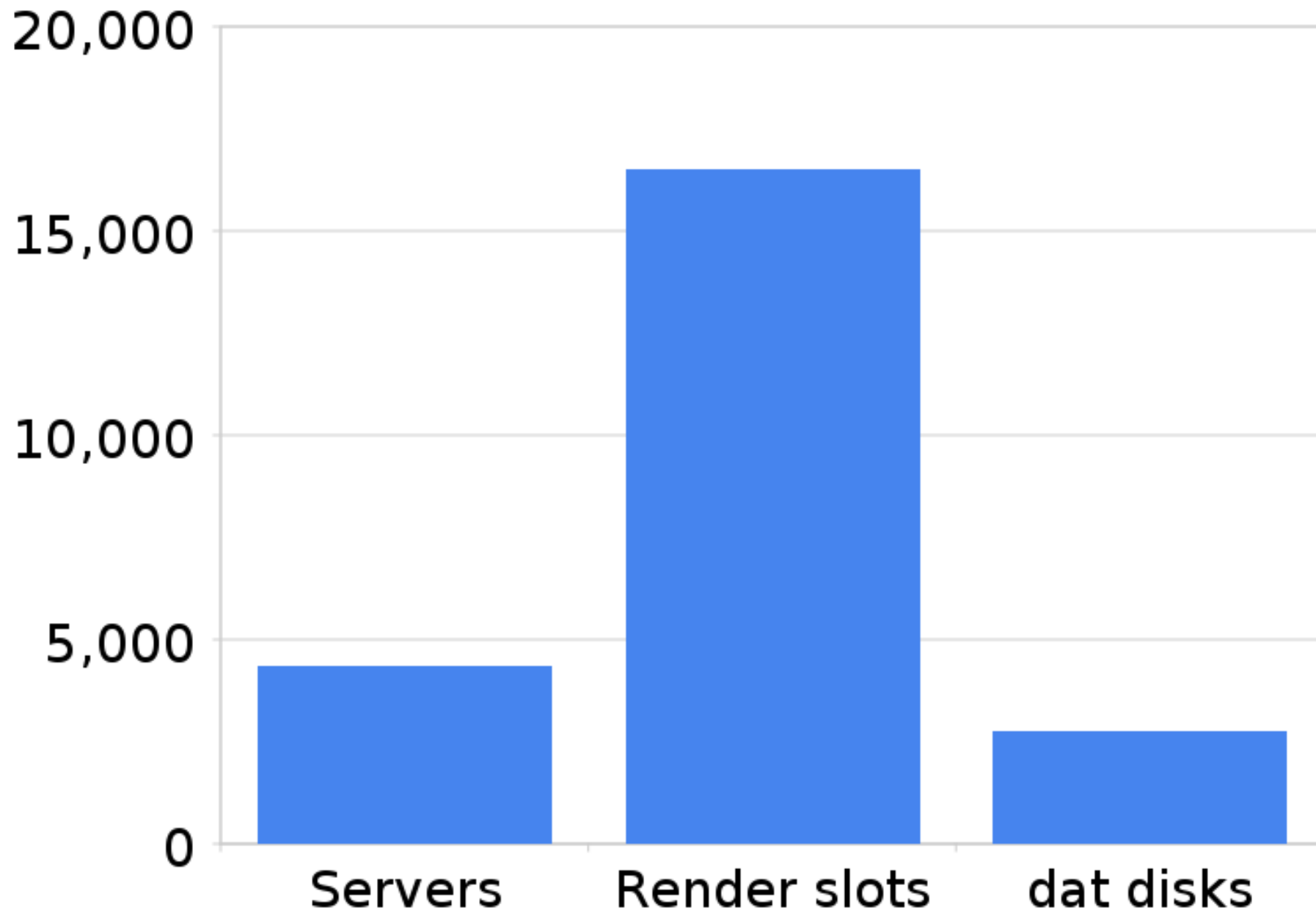


# Top 500 Gflops per capita

Rpeak Rmax

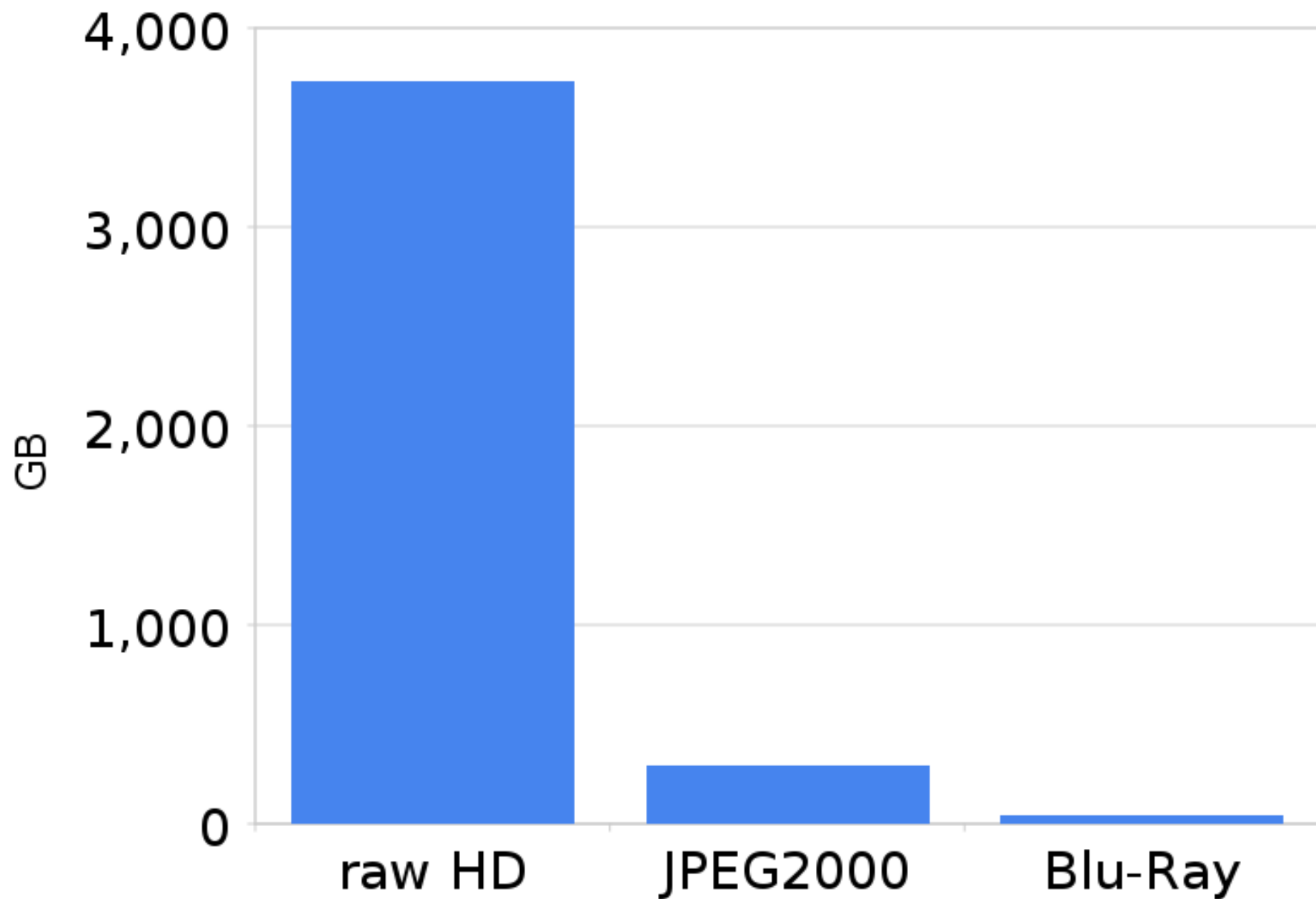


## Servers vs Spindles

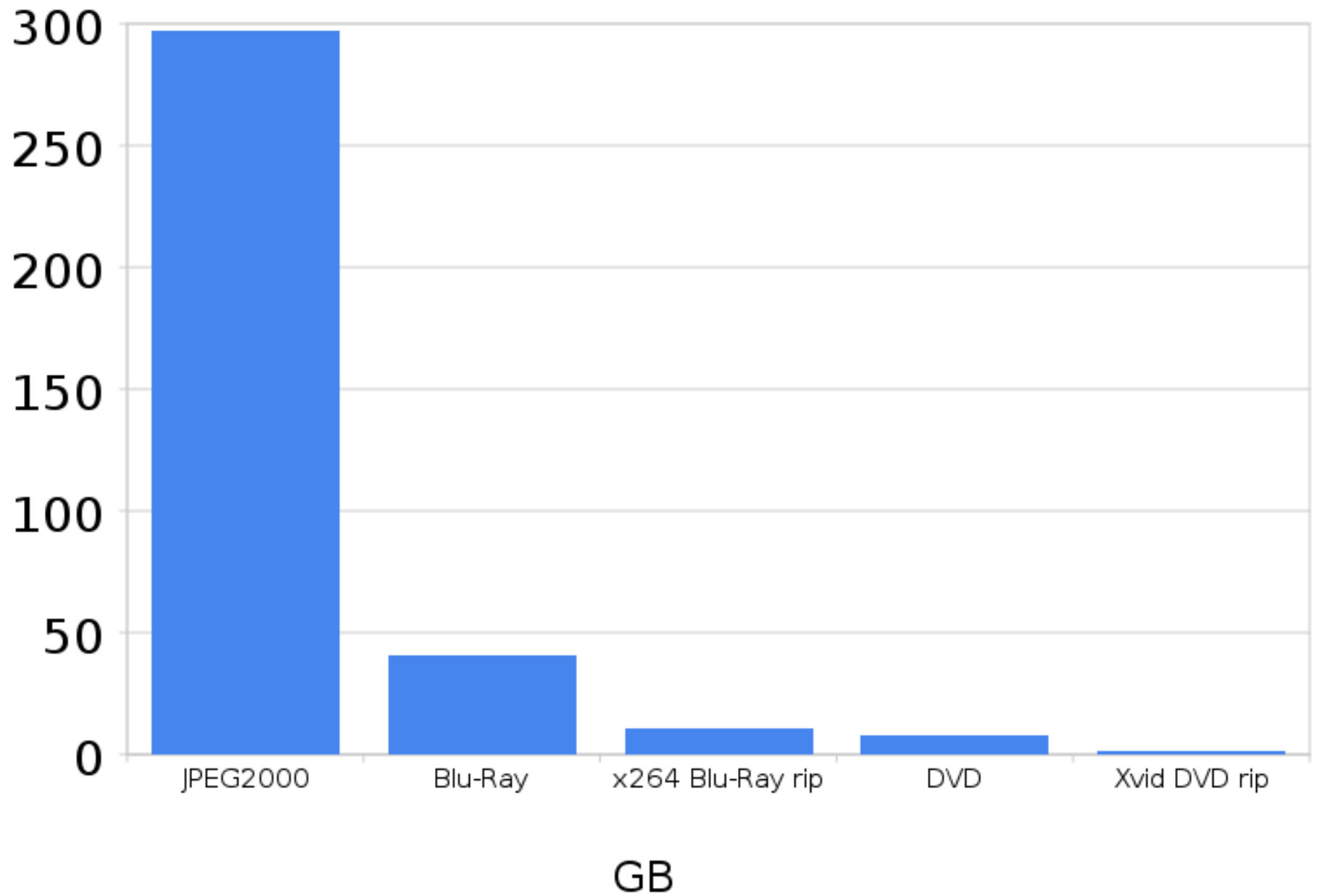




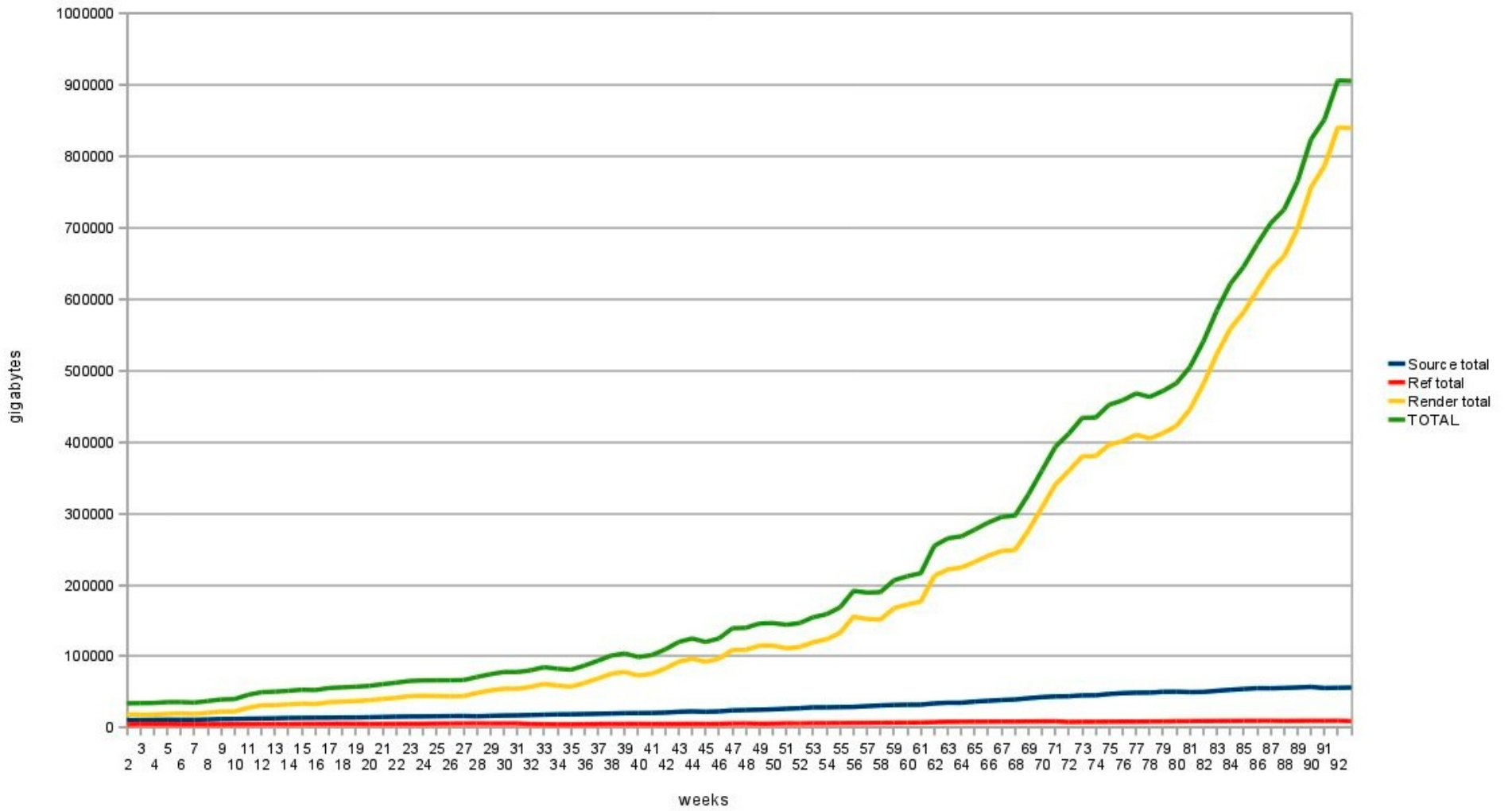
## Avatar Media Compression



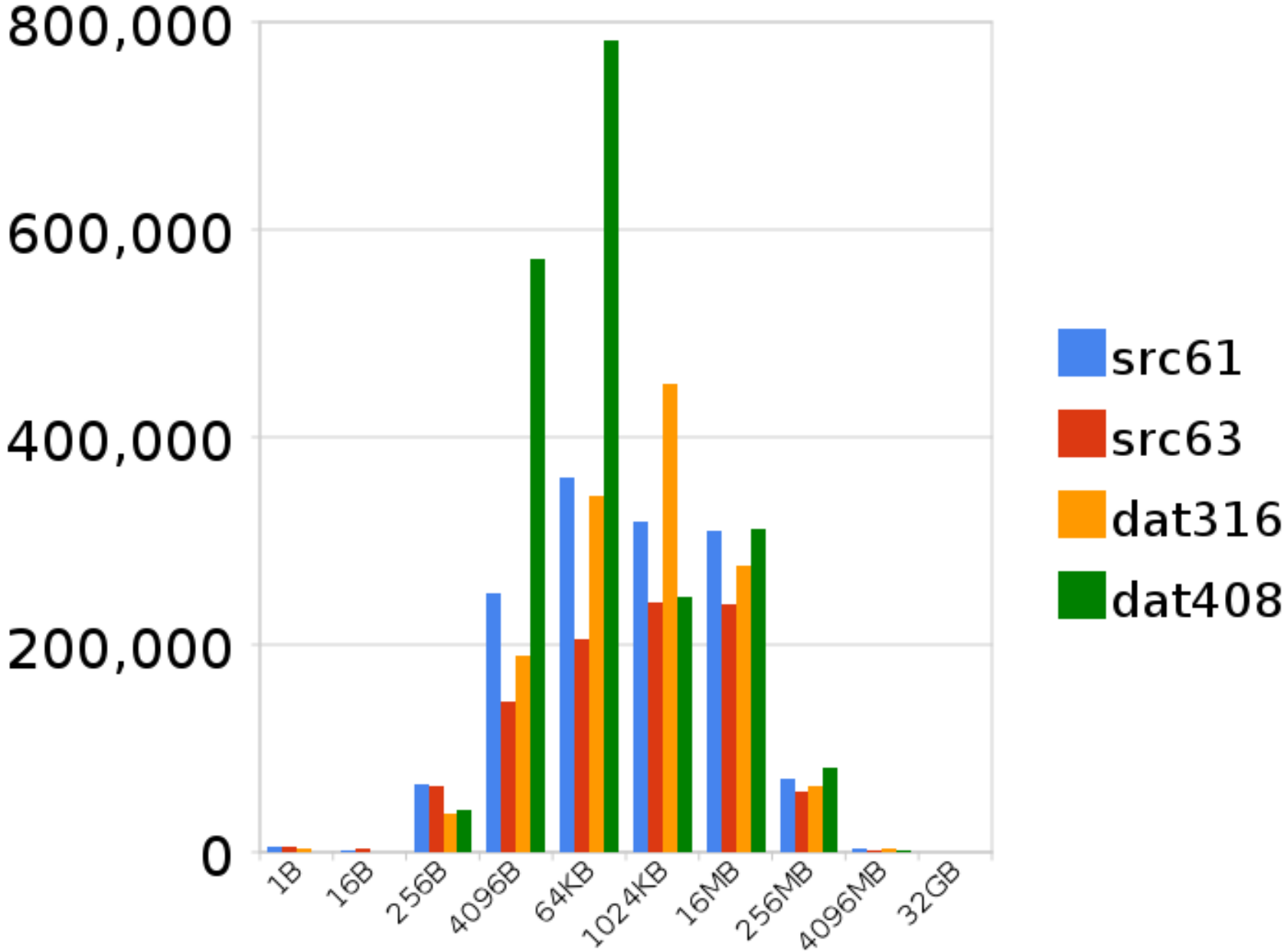
# Avatar Media Compression



Avatar diskspace over time



# File Size Distribution



# /proj/avatar/shots/294/350 (Shuttle Destruction)

archive -> /dsms/dat331/proj/avatar/shots/294/350/archive/

art -> /dsms/src44/proj/avatar/shots/294/350/art/

cam -> /dsms/src41/proj/avatar/shots/294/350/cam/  
cgd/

comp -> /dsms/src42/proj/avatar/shots/294/350/comp/

cre -> /dsms/src41/proj/avatar/shots/294/350/cre/

docs -> /dsms/src42/proj/avatar/shots/294/350/docs/  
grading/

layout -> /dsms/src48/proj/avatar/shots/294/350/layout/  
massive/

matte\_paint -> /dsms/src62/proj/avatar/shots/294/350/matte\_paint/

mocap -> /dsms/src42/proj/avatar/shots/294/350/mocap/

model -> /dsms/src42/proj/avatar/shots/294/350/model/

motion -> /dsms/src42/proj/avatar/shots/294/350/motion/  
paint/

plates/

ref/

render/

roto -> /dsms/src49/proj/avatar/shots/294/350/roto/

shaders -> /dsms/src44/proj/avatar/shots/294/350/shaders/

shots -> /dsms/src61/proj/avatar/shots/294/350/shots/  
textures/

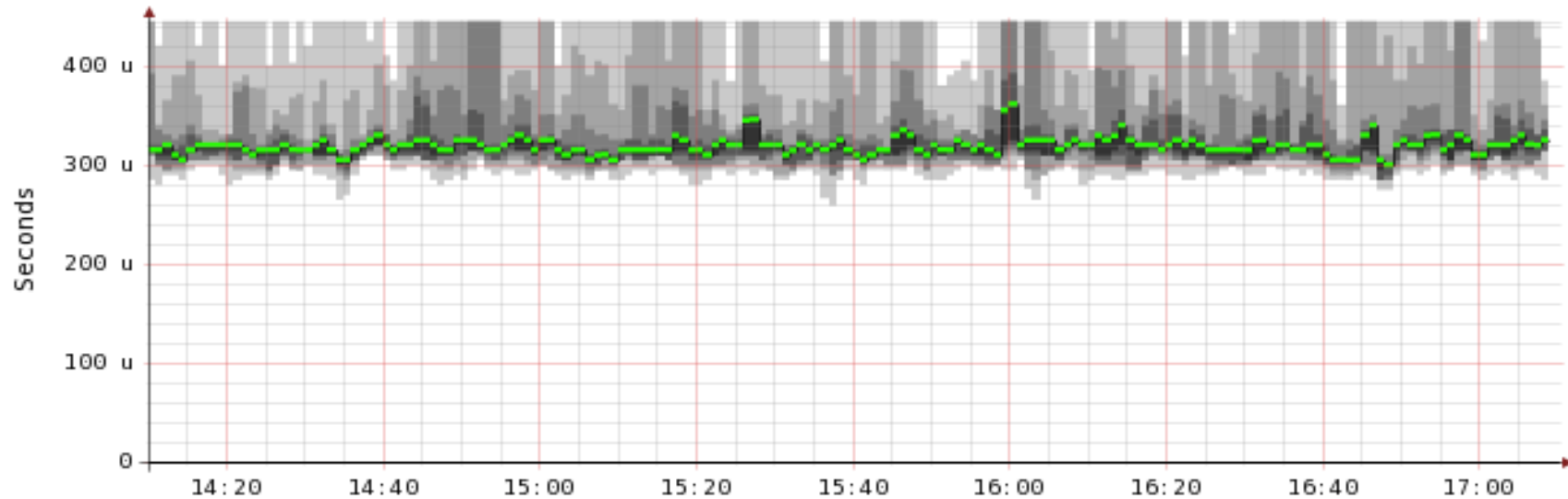
tmp -> /dsms/dat88/proj/avatar/shots/294/350/tmp/

render/comp/cmp/

s294\_350\_comp\_comp1080\_v84 ->

/dsms/dat413/proj/avatar/shots/294/350/render/comp/cmp/s294\_350\_comp\_comp1080\_v84/

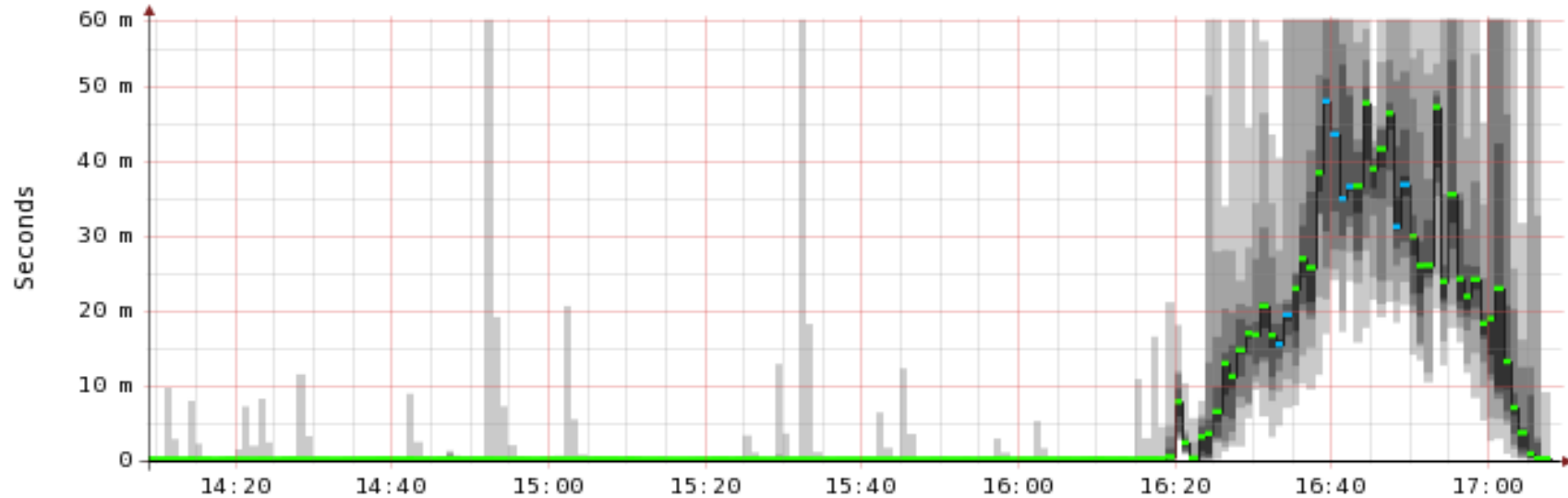
### Last 3 Hours



RRDTOOL / TOBI OETIKER

median rtt: 319.2 us avg 361.3 us max 300.0 us min 325.2 us now 0.0 ms sd 38.1 am/s  
packet loss: 0.00 % avg 0.00 % max 0.00 % min 0.00 % now  
loss color: 0 1/10 2/10 3/10 4/10 5/10 9/10  
probe: 10 ICMP Echo Pings (56 Bytes) every 60s end: Thu Oct 28 17:09:59 2010

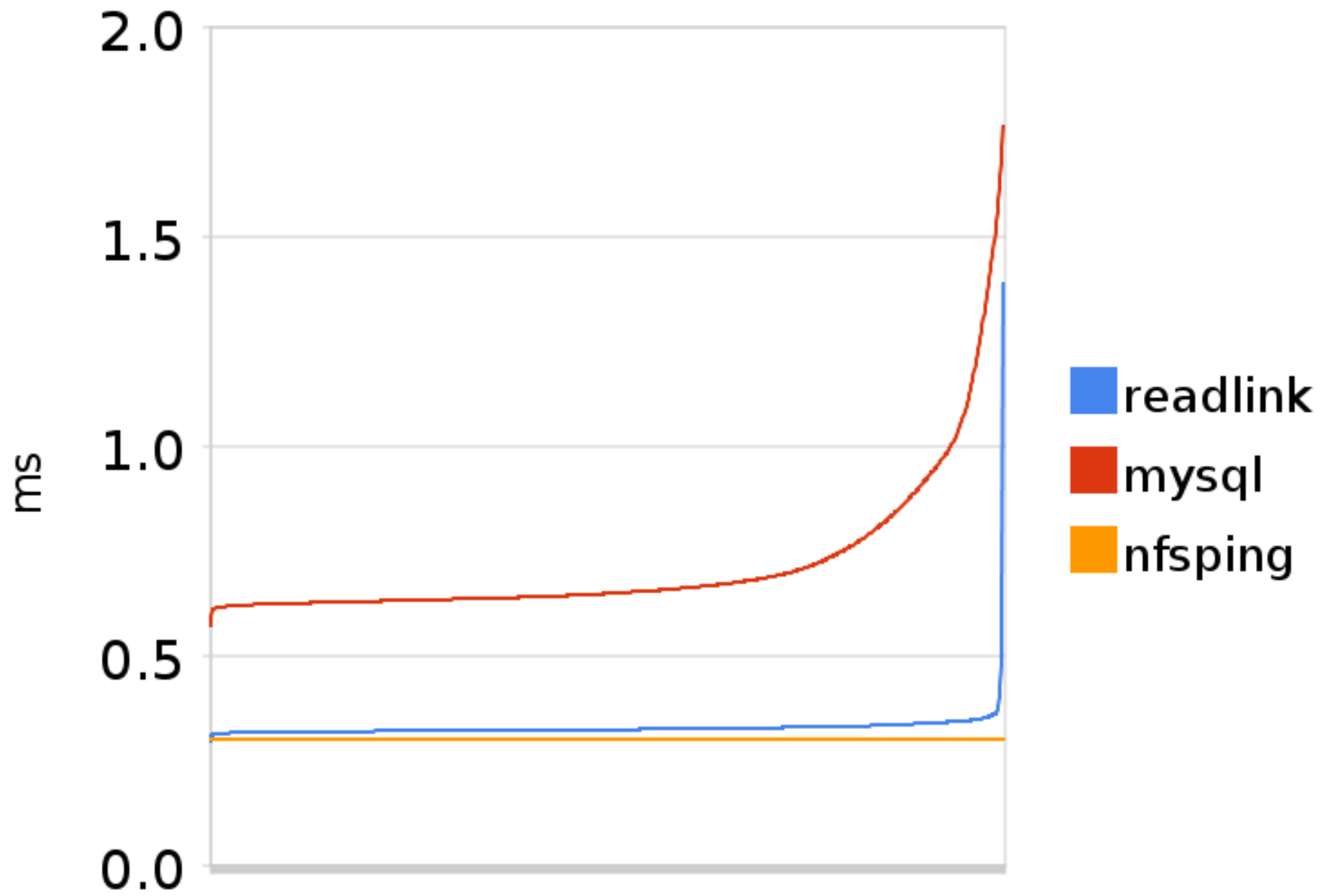
### Last 3 Hours



RRDTOOL / TOBI OETIKER

median rtt: 6.1 ms avg 48.0 ms max 184.0 us min 246.0 us now 12.2 ms sd 499.9 m am/s  
packet loss: 0.23 % avg 8.00 % max 0.00 % min 0.00 % now  
loss color: 0 1/10 2/10 3/10 4/10 5/10 9/10  
probe: 10 NFSping every 60s end: Thu Oct 28 17:08:49 2010

# DSMS path lookups



# Filermon ULTRA type R. V-spec II. With racing stripes.

## Overview

| Filer         | Filer Metrics |           |         |                 |       | Filer KB/s   |             | Renderwall KB/s |           |           | Ops/s     |         |        |        |        |            | Per-op Average Time (ms) |         |        |          |        |       | Client Count |
|---------------|---------------|-----------|---------|-----------------|-------|--------------|-------------|-----------------|-----------|-----------|-----------|---------|--------|--------|--------|------------|--------------------------|---------|--------|----------|--------|-------|--------------|
|               | CPU           | BM SM (s) | BM Read | Overload Metric | Load% | Net Out KB/s | Net In KB/s | Read            | Write     | Other     | Read      | Write   | Create | Rename | Remove | Other      | Read                     | Write   | Create | Rename   | Remove | Other |              |
| belgecn02     | 87            | 0.0       | 42      | 0               | 100   | 26,332       | 827,782     | 0               | 1,004,332 | 65        | 0         | 31,321  | 84     | 0      | 0      | 161        | 0.0                      | 141.2   | 47.2   | 0.0      | 0.0    | 3.4   | 446          |
| brownc03      | 0.0           |           |         |                 | 41    | 0            | 0           | 591,049         | 0         | 302       | 18,449    | 0       | 0      | 0      | 0      | 269        | 4.2                      | 0.0     | 0.0    | 0.0      | 0.0    | 0.1   | 1            |
| brownc04      | 0.0           |           |         |                 | 100   | 0            | 0           | 907,090         | 182,474   | 19,996    | 28,330    | 5,749   | 82     | 19     | 0      | 51,595     | 335.6                    | 1,983.6 | 791.6  | 33,684.2 | 0.0    | 6.7   | 1            |
| caribbean2    | 29            | 0.0       | 115     | 0               | 9     | 25,474       | 8,687       | 250,989         | 3,675     | 40,750    | 8,788     | 118     | 3      | 0      | 0      | 144,186    | 2.9                      | 3.2     | 0.7    | 0.0      | 0.0    | 0.3   | 321          |
| flores1       | 18            | 0.0       | 84      | 0               | 39    | 11,551       | 14,557      | 547,713         | 731,400   | 1,010     | 17,057    | 22,904  | 0      | 0      | 0      | 4,523      | 3.7                      | 4.4     | 0.0    | 0.0      | 0.0    | 0.1   | 1            |
| greencn01     | 2             | 0.0       | 113     | 0               | 42    | 1,356        | 84          | 1,213           | 0         | 0         | 38        | 0       | 0      | 0      | 0      | 0          | 4.3                      | 0.0     | 0.0    | 0.0      | 0.0    | 0.0   | 18           |
| greencn02     | 48            | 0.0       | 40      | 0               | 44    | 85,577       | 6,199       | 105,409         | 0         | 2         | 11,098    | 0       | 0      | 0      | 0      | 11         | 4.9                      | 0.0     | 0.0    | 0.0      | 0.0    | 0.2   | 612          |
| hithoe1       | 11            | 0.0       | 116     | 0               | 2     | 1,353        | 652         | 0               | 0         | 0         | 0         | 0       | 0      | 0      | 0      | 0          | 0.0                      | 0.1     | 0.0    | 0.0      | 0.0    | 0.0   | 1            |
| hithoe2       | 9             | 0.0       | 115     | 0               | 100   | 7,044        | 277         | 2,395           | 0         | 14        | 71        | 0       | 0      | 0      | 0      | 105        | 363.4                    | 0.0     | 0.0    | 0.0      | 0.0    | 0.2   | 67           |
| lonlan1       | 9             | 0.0       | 116     | 0               | 4     | 552          | 597         | 202             | 6         | 289,102   | 151       | 19      | 2      | 0      | 0      | 1,209,644  | 0.1                      | 0.2     | 0.1    | 0.0      | 0.0    | 0.2   | 274          |
| lonlan2       | 9             | 0.0       | 114     | 0               | 6     | 589          | 625         | 0               | 0         | 267       | 0         | 0       | 0      | 0      | 0      | 1,189      | 0.1                      | 0.0     | 0.0    | 0.0      | 0.0    | 0.3   | 11           |
| marama1       | 75            | 0.0       | 112     | 0               | 6     | 58,429       | 115,115     | 558             | 104       | 1,666     | 55        | 7       | 0      | 0      | 0      | 7,199      | 0.6                      | 1.7     | 0.3    | 0.3      | 0.0    | 0.3   | 236          |
| marama1-homes |               | 0.0       |         |                 | 8     | 0            | 0           | 7,908           | 3,175     | 14,662    | 389       | 256     | 19     | 9      | 20     | 60,951     | 2.2                      | 2.1     | 0.5    | 0.3      | 0.4    | 0.3   | 19           |
| orangecn01    | 24            | 0.0       | 65      | 0               | 31    | 35,990       | 56,436      | 67,842          | 107,522   | 105       | 3,669     | 6,683   | 7      | 1      | 2      | 421        | 3.4                      | 2.1     | 0.4    | 9.7      | 0.7    | 0.7   | 3396         |
| orangecn02    | 26            | 0.0       | 108     | 0               | 44    | 149,563      | 38,913      | 372,658         | 38,089    | 69        | 13,369    | 1,314   | 7      | 0      | 2      | 290        | 5.2                      | 3.4     | 0.5    | 0.1      | 0.5    | 0.4   | 1277         |
| orangecn03    | 21            | 0.0       | 93      | 0               | 36    | 166,347      | 191,039     | 201,033         | 154,426   | 327       | 7,669     | 9,171   | 6      | 0      | 1      | 1,258      | 4.8                      | 2.2     | 0.4    | 0.2      | 0.5    | 0.2   | 2311         |
| orangecn04    | 22            | 0.0       | 58      | 0               | 41    | 189,577      | 68,086      | 286,957         | 212,640   | 813       | 10,170    | 7,210   | 83     | 66     | 39     | 2,851      | 5.4                      | 3.7     | 0.8    | 1.0      | 0.5    | 1.0   | 2389         |
| redcn01       | 17            | 0.0       | 75      | 0               | 42    | 103,956      | 68,244      | 143,527         | 77,005    | 207       | 5,462     | 2,585   | 11     | 2      | 4      | 713        | 5.3                      | 3.5     | 0.8    | 0.9      | 0.7    | 0.2   | 1163         |
| redcn02       | 16            | 0.0       | 84      | 0               | 35    | 69,408       | 85,573      | 85,215          | 98,216    | 444       | 3,766     | 3,220   | 4      | 0      | 1      | 1,405      | 3.5                      | 3.8     | 0.4    | 0.0      | 0.3    | 0.3   | 948          |
| redcn03       | 14            | 0.0       | 111     | 0               | 39    | 43,186       | 71,065      | 808,996         | 520,207   | 4,423     | 29,643    | 19,437  | 113    | 67     | 49     | 17,472     | 5.2                      | 4.1     | 1.4    | 1.1      | 0.8    | 0.6   | 1009         |
| redcn04       | 19            | 0.0       | 98      | 0               | 45    | 87,099       | 84,720      | 120,524         | 129,540   | 75        | 4,493     | 4,193   | 6      | 0      | 0      | 333        | 6.1                      | 4.1     | 0.5    | 0.3      | 0.2    | 0.4   | 1353         |
| salton1       | 22            | 0.0       | 0       | 0               | 8     | 114,035      | 11,250      | 3,439,698       | 589       | 529,257   | 124,687   | 27      | 0      | 0      | 0      | 2,031,672  | 2.8                      | 3.5     | 0.1    | 0.0      | 0.0    | 0.2   | 1625         |
| salton2       | 52            | 0.0       | 0       | 0               | 17    | 146,037      | 4,620       | 10,351,732      | 192       | 926,245   | 378,553   | 26      | 1      | 0      | 0      | 3,494,075  | 3.6                      | 2.0     | 3.3    | 0.0      | 0.3    | 0.7   | 2729         |
| salton3       | 62            | 0.0       | 0       | 0               | 19    | 245,911      | 10,929      | 2,639,635       | 649       | 246,736   | 98,190    | 315     | 16     | 0      | 0      | 924,948    | 3.8                      | 7.8     | 1.1    | 0.0      | 0.0    | 0.8   | 2456         |
| salton4       | 66            | 0.0       | 0       | 0               | 19    | 355,575      | 4,404       | 8,707,028       | 59        | 865,054   | 319,425   | 25      | 0      | 0      | 0      | 3,268,843  | 3.5                      | 1.3     | 0.1    | 0.0      | 0.0    | 0.9   | 2844         |
| salton5       | 43            | 0.0       | 0       | 0               | 13    | 193,629      | 11,914      | 3,544,041       | 1,292     | 312,868   | 131,007   | 52      | 1      | 0      | 0      | 1,182,473  | 2.8                      | 3.8     | 2.7    | 0.0      | 0.3    | 0.4   | 2477         |
| salton6       | 51            | 0.0       | 0       | 0               | 20    | 217,233      | 4,600       | 3,749,193       | 1,658     | 405,966   | 139,146   | 72      | 0      | 0      | 0      | 1,531,555  | 3.7                      | 3.7     | 0.3    | 0.0      | 0.0    | 1.0   | 2708         |
| salton7       | 37            | 0.0       | 0       | 0               | 10    | 121,468      | 3,134       | 674,234         | 96        | 199,957   | 25,829    | 13      | 1      | 0      | 0      | 784,293    | 2.6                      | 2.1     | 2.4    | 0.1      | 1.9    | 0.4   | 2300         |
| salton8       | 49            | 0.0       | 0       | 0               | 10    | 260,225      | 3,502       | 7,397,456       | 1,617     | 845,728   | 270,072   | 71      | 1      | 0      | 0      | 3,198,914  | 2.8                      | 3.5     | 0.7    | 0.0      | 0.2    | 0.3   | 2765         |
| whiteshark    |               | 0.0       |         |                 | 49    | 0            | 0           | 32              | 0         | 0         | 0         | 0       | 0      | 0      | 0      | 0          | 0.0                      | 0.0     | 0.0    | 0.0      | 0.0    | 6.0   | 2            |
| yellowcn01    | 62            | 0.0       | 67      | 0               | 47    | 601,932      | 278,993     | 788,128         | 177,841   | 458       | 25,876    | 19,970  | 8      | 0      | 1      | 1,447      | 6.2                      | 5.0     | 30.3   | 3.7      | 52.6   | 0.8   | 2531         |
| yellowcn02    | 45            | 0.0       | 76      | 0               | 47    | 301,623      | 253,346     | 961,596         | 658,107   | 1,173     | 32,852    | 21,874  | 204    | 198    | 114    | 2,928      | 6.9                      | 4.5     | 0.7    | 0.9      | 0.5    | 0.3   | 1625         |
| yellowcn03    | 40            | 0.0       | 68      | 0               | 41    | 379,011      | 218,127     | 562,731         | 405,149   | 847       | 20,770    | 14,709  | 139    | 132    | 77     | 2,371      | 5.1                      | 3.7     | 0.6    | 0.8      | 0.4    | 0.3   | 2517         |
| yellowcn04    | 38            | 0.0       | 103     | 0               | 39    | 239,545      | 236,747     | 439,611         | 192,926   | 614       | 15,042    | 8,115   | 24     | 13     | 8      | 2,052      | 4.6                      | 3.2     | 0.5    | 0.9      | 0.5    | 0.3   | 2895         |
| TOTAL:        |               |           |         |                 |       | 4,239,607    | 2,680,217   | 47,756,393      | 4,702,986 | 4,709,202 | 1,744,116 | 179,456 | 822    | 508    | 320    | 17,930,147 |                          |         |        |          |        |       |              |



\$cat /proc/self/mountstats

device yellow007:/cns/dat307 mounted on /dsms/dat307 with fstype nfs statvers=1.0

opts: rw,vers=3,rsz=32768,wsz=32768,acregmin=3,acregmax=60,acdirmin=30,  
acdirmax=60,hard,proto=tcp,timeo=600,retrans=2,sec=sys

age: 4

caps: caps=0x1,wtmult=32768,dtsz=4096,bsz=0,namelen=255

sec: flavor=1,pseudoflavor=1

events: 0 0 0 0 1 10 11 0 0 2 0 2 0 0 0 0 0 0 0 0 0 0 0

bytes: 49310 0 0 0 81920 0 20 0

RPC iostats version: 1.0 p/v: 100003/3 (nfs)

xprt: tcp 690 0 2 0 4 27 27 0 28 0

per-op statistics

NULL: 0 0 0 0 0 0 0 0

GETATTR: 0 0 0 0 0 0 0 0

SETATTR: 0 0 0 0 0 0 0 0

LOOKUP: 10 10 0 1256 2400 0 3 3

ACCESS: 11 11 0 1288 1320 0 1 1

READLINK: 0 0 0 0 0 0 0 0

READ: 3 3 0 384 82304 0 29 29

WRITE: 0 0 0 0 0 0 0 0

CREATE: 0 0 0 0 0 0 0 0

MKDIR: 0 0 0 0 0 0 0 0

SYMLINK: 0 0 0 0 0 0 0 0

MKNOD: 0 0 0 0 0 0 0 0

REMOVE: 0 0 0 0 0 0 0 0

RMDIR: 0 0 0 0 0 0 0 0

RENAME: 0 0 0 0 0 0 0 0

LINK: 0 0 0 0 0 0 0 0

REaddir: 0 0 0 0 0 0 0 0

REaddirPLUS: 0 0 0 0 0 0 0 0

FSSTAT: 0 0 0 0 0 0 0 0

FSINFO: 1 1 0 112 164 0 0 0

PATHCONF: 0 0 0 0 0 0 0 0

COMMIT: 0 0 0 0 0 0 0 0