

AV2.16 Stitcher/Session Memory Use - All  
markets

Charter Internal Note.

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## 1 Introduction

Session Size analysis was performed in AV2.11, which showed memory usage to be significantly higher than was expected. AV2.16 brings changes to webkit, which are expected to bring the largest sessions down in size due to improvements to the garbage collector which de-allocates memory which is no longer in use. Further improvements are expected with the delivery of changes to SGUI's NNS project. With these performance improvements underway, this document serves as a look into the performance provided by the switch to Webkit-V3 bundled in the deployment of AV2.16.

## 2 RSS vs. SIZE

The Resident Set Size(RSS) of a process in Linux is a measure of memory used, but does not include memory which is swapped out, or memory which is being used in shared memory libraries. Virtual Memory Size (VMS) aka SIZE includes all memory the process can access, including swap memory and memory which has been allocated but not used. This means that RSS under-reports memory used, while VMS over-reports memory used. In AV2.16 VMS has become unusable for capacity planning because of how memory is allocated in webkit-V3. RSS in AV2.16. Linux reports that RSS used by a webkit process may be 380 MB, while the VMS is allocating 100GB per session on stitchers that only have 128 GB or 256 GB of memory. There are three usual causes for large virtual memory utilization which don't materialize into real memory usage as we are seeing. Those are extensive use of swap memory, use of large shared libraries, and memory which is allocated to the buffer/cache but is not used. A 'free -m' command reveals no use of swap memory, some use of shared memory, but does show up as a significant allocation to buffer/cache memory. The use of buffer/cache memory was also present in AV2.11, but did not show in the VMS SIZE reporting. Some shared memory libraries are being used, but not at the level to explain the VMS reported size of each process. A better understanding of how webkit manages its memory allocations and shared memory will be necessary going forward to ensure accurate capacity planning can be accomplished in AV2.16+ environments.

## 3 Memory Consumption AV2.11

The memory utilization of the html5client process on the Portland stitchers in AV2.11 is summarized in table 1. Here we can see the difference between RSS and VMS reported by Linux. The average AV2.11 session is using 815MB of memory when reported by RSS, and 1175 MB (over 1 GB) of memory when reported by SIZE (VMS). This difference comes down to buffer/cache memory and shared memory utilization in the webkit-V2 environment. It is worth noting that the largest session in Portland at the time of measurement was 6.7GB RSS which corresponds to 8.7GB VMS.

pldcor	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	389	389.000000	389.000000	389.00000
mean	1 days 05:24:52.033419	11.805141	815.620380	1175.33370
std	5 days 16:38:37.442890	24.115209	733.513476	1041.47454
min	0 days 00:00:01	0.000000	125.612000	211.30800
25%	0 days 00:01:08	0.300000	330.576000	576.40000
50%	0 days 00:14:33	2.300000	636.780000	919.36800
75%	0 days 01:38:37	8.500000	1054.984000	1405.63200
max	37 days 14:45:31	99.900000	6727.340000	8748.13200

Table 1: Size of the html5client in AV2.11 from PLDCOR.

## 4 Memory Consumption AV2.16

The one `html5client` process from AV2.11 has been split up into three processes in AV2.16. Those three processes are `html5client-v3`, `WebKitWebProces`, and `WebKitNetworkProcess`. Use metrics for `html5client-v3` can be seen in appendix A. Use metrics for `WebKitWebProces` can be seen in appendix A. Use metrics for `WebKitNetworkProcess` can be seen in appendix A. All three of these processes contribute to session memory utilization.

By taking these three processes and combining them we can get a comparable result for session memory utilization. Each process's average utilization can be added, and their standard deviations can be added in quadrature to yield a meaningful result. Take Portland as an example to compare with the 2.11 results presented in the previous section. The `html5` process has RSS of  $43 \pm 8$  MB, `WebkitWeb`  $292 \pm 89$  MB, and `WebKitNet`  $32 \pm 2$  MB. This gives an overall session RSS of  $367 \pm 85$  MB. Because of the overallocation of memory by `webkit-v3` a result for the VMS SIZE is not meaningful. This RSS measurement, by the nature of how RSS is reported, under-represents the actual memory used. The use of `'free -m` revealed approx 1-3 GB of shared libraries loaded into memory in `pldcor` which is not included in the RSS session size reporting. Shared memory increased in `bodcma` (a docsis market) from AV2.11 to AV2.16, from between 2-5GB in AV2.11 up to 7-10GB in AV2.16 per stitcher. Further measurements of shared memory use will be required to fully assess capacity on a per market basis. Session size, however, will be the majority contributor to capacity, using approx. 10x more memory than shared memory allocations even with the increases in shared memory.

## 5 Impacts on Capacity Modeling

Since the core processes of how SGUI is delivered, changes to the capacity model are required. The old capacity model is

$$Capacity_{AV2.11} = \frac{Mem * 0.8 * 1000}{SesSize + 2.32 * SesVar}$$

which is described in the stitcher capacity document. Since that was based on one process the *SesSize* and *SesVar* were more easily measurable. With three processes the *Size* and *Var* for each of the three processes are needed. Sizes can be measured in the same way for each process, and then added for a total average session size. The *Var* needs to be measured for each process, and then added in quadrature. This means  $SesVar = \sqrt{Var_{html}^2 + Var_{WebKitWeb}^2 + Var_{WebKitNet}^2}$ . Because the use of RSS is required shared memory use also must be included in order to get accurate memory use. This means that an allocation for shared memory use must be subtracted from the total available memory. This means the new capacity model adjusted for changes in AV2.16 is

$$Capacity_{AV2.16} = \frac{Mem * 0.8 * 1000 - (SharedMem + 2.32 * SharedMemVar)}{SesSize + 2.32 * SesVar}$$

where *SharedMem* is the average shared memory for stitchers on the market, *SharedMemVar* is the standard deviation of shared memory for stitchers on the market, *SesSize* and *SesVar* have been adjusted to account for all three processes as described above, and an allocation of 2.32 standard deviations has been made to account for stitchers using above average shared memory. The 2.32 factor is the statistical Z-Score corresponding to 99% coverage for this allocation.

## 6 Conclusion

In AV2.11 average session RSS was approx. 750 MB (See 2018 stitcher capacity analysis documentation for further 2.11 session resource and capacity information). In 2.16 RSS averaged approx. 350 MB, which is a reduction of nearly 55%. The reduction in variance of session size will also have an outsized effect in reducing stitcher capacity requirements since production is no longer required to support sessions that could grow to take up to 20 GB of memory in the extreme cases. Furthermore differences between RDCs have all but disappeared. In 2.11 session size was considerably larger in QAM markets compared to DOCSIS, and since all sessions were brought down to a fixed size QAM markets saw a greater reduction in memory use and a greater reclamation of capacity. Capacity analysis for the 2021 budget year will be based upon the resource utilization in this session size analysis.

## A Appendix A Session Size html5client-v3

bhdcal-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1610	1610.000000	1610.000000	1610.000000
mean	0 days 00:48:57.392546	0.845776	41.728122	91930.678482
std	0 days 01:09:19.679782	1.445749	6.657195	8373.806943
min	0 days 00:00:00	0.000000	18.944000	83989.664000
25%	0 days 00:03:39.500000	0.000000	37.317000	84086.631000
50%	0 days 00:25:32.500000	0.200000	41.290000	84104.786000
75%	0 days 01:11:35.750000	1.100000	45.269000	100863.684000
max	0 days 15:27:45	18.700000	65.468000	100898.256000

bhnal-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	33	33.000000	33.000000	33.000000
mean	0 days 01:11:55.909090	0.200000	43.264000	88153.098061
std	0 days 01:35:45.977105	0.280624	8.563597	7296.931955
min	0 days 00:01:50	0.000000	26.648000	84058.288000
25%	0 days 00:17:19	0.000000	38.828000	84084.476000
50%	0 days 00:44:06	0.100000	42.940000	84091.516000
75%	0 days 01:17:18	0.300000	45.356000	84107.096000
max	0 days 08:15:11	1.200000	62.840000	100882.392000

bhnca-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	66	66.000000	66.000000	66.000000
mean	0 days 00:36:18.984848	0.821212	42.186182	93738.547697
std	0 days 00:46:33.948633	1.127081	9.229592	8356.842430
min	0 days 00:00:02	0.000000	26.740000	84015.276000
25%	0 days 00:02:46.250000	0.025000	37.045000	84088.740000
50%	0 days 00:12:23.500000	0.200000	40.024000	100837.102000
75%	0 days 00:57:01.250000	1.500000	45.443000	100862.645000
max	0 days 03:23:06	4.600000	79.152000	100887.136000

bhnfl-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	15	15.000000	15.000000	15.000000
mean	0 days 00:27:13.333333	0.886667	39.752800	88552.313067
std	0 days 00:40:27.321618	1.199921	5.484201	7679.358397
min	0 days 00:00:11	0.000000	32.364000	84056.800000
25%	0 days 00:01:39.500000	0.100000	37.210000	84071.544000
50%	0 days 00:05:53	0.500000	38.784000	84089.080000
75%	0 days 00:27:23	1.100000	40.832000	92467.026000
max	0 days 02:00:49	4.700000	56.468000	100866.324000

bhnoh-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	67	67.000000	67.000000	67.000000
mean	0 days 00:57:42.402985	0.611940	41.536537	91846.414149
std	0 days 01:13:40.561314	1.230364	6.609191	8428.230055
min	0 days 00:00:08	0.000000	25.668000	84040.620000
25%	0 days 00:06:05	0.000000	37.174000	84087.300000
50%	0 days 00:36:09	0.100000	41.248000	84102.192000
75%	0 days 01:22:45	0.650000	46.014000	100861.276000
max	0 days 07:02:36	7.400000	58.140000	100885.588000

blngmt-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	384	384.000000	384.000000	384.000000
mean	0 days 00:45:19.510416	0.800781	42.885448	92036.232146
std	0 days 00:55:09.336985	1.253788	7.546467	8388.127074
min	0 days 00:00:01	0.000000	25.868000	84014.252000
25%	0 days 00:03:10.500000	0.000000	38.267000	84087.370000
50%	0 days 00:24:52	0.200000	41.636000	84103.220000
75%	0 days 01:10:04.500000	1.200000	46.807000	100864.849000
max	0 days 05:06:35	7.500000	70.920000	100891.776000

bodcma-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	745	745.000000	745.000000	745.000000
mean	0 days 00:49:00.148993	0.693691	41.046862	93993.010851
std	0 days 01:05:13.394838	1.300600	6.449886	8254.543074
min	0 days 00:00:00	0.000000	22.616000	84014.256000
25%	0 days 00:04:43	0.000000	36.728000	84091.800000
50%	0 days 00:26:31	0.100000	40.520000	100843.152000
75%	0 days 01:06:58	0.800000	44.704000	100866.328000
max	0 days 10:56:47	10.300000	67.116000	100895.516000

dldctx-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1171	1171.000000	1171.000000	1171.000000
mean	0 days 00:49:34.921434	0.778309	41.617196	91175.302179
std	0 days 01:06:54.700392	1.536332	6.493075	8291.596696
min	0 days 00:00:00	0.000000	21.892000	83989.668000
25%	0 days 00:04:10	0.000000	37.440000	84083.408000
50%	0 days 00:27:16	0.200000	41.152000	84099.524000
75%	0 days 01:11:29.500000	0.900000	45.124000	100860.032000
max	0 days 14:05:44	22.500000	67.480000	100894.396000



edprmn-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	480	480.000000	480.000000	480.000000
mean	0 days 00:54:37.502083	0.286042	43.525900	94531.532375
std	0 days 01:11:51.282699	0.582910	8.159511	8138.434973
min	0 days 00:00:00	0.000000	21.052000	84017.336000
25%	0 days 00:10:01.750000	0.000000	38.330000	84091.038000
50%	0 days 00:37:08	0.000000	42.862000	100843.978000
75%	0 days 01:11:03	0.200000	48.024000	100863.833000
max	0 days 14:02:59	4.300000	74.444000	100895.440000

knwdmi-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1201	1201.000000	1201.000000	1201.000000
mean	0 days 00:56:36.631973	0.385845	44.459694	91764.100150
std	0 days 01:11:19.525166	0.758858	8.467042	8362.269247
min	0 days 00:00:00	0.000000	21.864000	84017.332000
25%	0 days 00:05:43	0.000000	38.672000	84081.488000
50%	0 days 00:32:46	0.100000	43.260000	84102.176000
75%	0 days 01:17:35	0.400000	49.576000	100859.040000
max	0 days 10:19:45	8.600000	83.508000	100889.488000

ladcca-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1403	1403.000000	1403.000000	1403.000000
mean	0 days 00:38:09.417676	0.817676	45.029577	90371.369996
std	0 days 00:54:53.942138	1.403054	9.515955	8124.644536
min	0 days 00:00:00	0.000000	21.392000	84014.252000
25%	0 days 00:03:12.500000	0.000000	38.124000	84081.162000
50%	0 days 00:20:48	0.200000	43.364000	84095.888000
75%	0 days 00:56:39.500000	1.000000	51.788000	100854.438000
max	0 days 14:18:11	13.800000	74.624000	100893.364000

mddcwi-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1186	1186.000000	1186.000000	1186.000000
mean	0 days 00:53:53.714165	0.354553	43.928698	91918.874364
std	0 days 01:06:24.654938	0.634294	8.526275	8374.604469
min	0 days 00:00:01	0.000000	22.904000	84014.260000
25%	0 days 00:05:43.250000	0.000000	38.162000	84083.415000
50%	0 days 00:31:22	0.100000	43.000000	84101.752000
75%	0 days 01:17:13.250000	0.400000	49.064000	100861.746000
max	0 days 07:30:47	4.400000	80.688000	100888.892000

nvdctn-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1094	1094.000000	1094.000000	1094.000000
mean	0 days 00:52:06.447897	0.845887	41.872998	93976.009832
std	0 days 01:14:26.437044	1.375979	6.696925	8257.379288
min	0 days 00:00:00	0.000000	21.928000	84014.252000
25%	0 days 00:03:12.250000	0.000000	37.437000	84091.606000
50%	0 days 00:27:01	0.200000	41.252000	100842.892000
75%	0 days 01:10:19.250000	1.175000	45.632000	100868.118000
max	0 days 11:03:42	12.000000	66.340000	100898.100000

pldcor-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	584	584.000000	584.000000	584.000000
mean	0 days 00:40:51.208904	0.487500	42.592384	90888.734747
std	0 days 00:56:35.332522	0.853927	7.694936	8245.385651
min	0 days 00:00:00	0.000000	21.092000	84014.256000
25%	0 days 00:02:59.750000	0.000000	37.645000	84079.467000
50%	0 days 00:22:36	0.100000	41.868000	84096.716000
75%	0 days 00:58:13.250000	0.700000	47.186000	100855.745000
max	0 days 10:31:57	7.900000	72.548000	100890.632000

renonv-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	454	454.000000	454.000000	454.000000
mean	0 days 00:45:45.182819	0.432379	42.805947	93172.691392
std	0 days 00:58:36.935983	0.753702	7.549233	8368.965441
min	0 days 00:00:00	0.000000	21.204000	84014.260000
25%	0 days 00:04:22.500000	0.000000	38.010000	84086.378000
50%	0 days 00:27:25	0.100000	41.950000	100834.294000
75%	0 days 01:02:54	0.600000	47.473000	100863.291000
max	0 days 07:47:15	6.400000	68.380000	100889.688000

sldcla-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	358	358.000000	358.000000	358.000000
mean	0 days 00:53:47.952513	0.313966	44.151229	92704.113318
std	0 days 01:05:31.936912	0.664317	8.465915	8396.835646
min	0 days 00:00:00	0.000000	19.124000	84014.252000
25%	0 days 00:10:17.250000	0.000000	38.100000	84083.028000
50%	0 days 00:35:28.500000	0.000000	42.828000	100821.002000
75%	0 days 01:10:26.750000	0.300000	49.422000	100861.007000
max	0 days 09:20:16	5.400000	71.148000	100886.332000

sldcmo-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1960	1960.000000	1960.000000	1960.000000
mean	0 days 00:57:12.254081	0.339796	45.220496	92136.842069
std	0 days 01:08:44.584893	0.665521	8.924608	8384.051131
min	0 days 00:00:00	0.000000	21.640000	84014.260000
25%	0 days 00:08:22.500000	0.000000	38.971000	84084.049000
50%	0 days 00:34:50.500000	0.100000	44.126000	84106.528000
75%	0 days 01:19:10.250000	0.300000	51.000000	100861.550000
max	0 days 07:59:52	7.000000	77.400000	100891.412000

slotca-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	415	415.000000	415.000000	415.000000
mean	0 days 00:34:48.346987	0.891807	39.374467	93948.175672
std	0 days 00:41:46.707269	1.481881	5.702702	8268.092300
min	0 days 00:00:00	0.000000	22.184000	84014.252000
25%	0 days 00:03:24	0.000000	35.796000	84089.894000
50%	0 days 00:19:58	0.300000	38.640000	100842.732000
75%	0 days 00:53:37	1.100000	42.374000	100867.184000
max	0 days 04:49:07	14.600000	60.432000	100887.364000

spdcsc-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1837	1837.000000	1837.000000	1837.000000
mean	0 days 00:56:19.407729	0.382744	45.440627	92354.721653
std	0 days 01:06:18.372934	0.717940	9.169870	8390.665577
min	0 days 00:00:00	0.000000	21.852000	84014.264000
25%	0 days 00:05:33	0.000000	39.040000	84082.824000
50%	0 days 00:35:42	0.100000	44.368000	84108.360000
75%	0 days 01:23:42	0.400000	51.016000	100860.996000
max	0 days 09:28:03	6.300000	76.912000	100891.812000

twcca-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	4761	4761.000000	4761.000000	4761.000000
mean	0 days 00:38:55.805713	0.820542	40.422416	93456.270878
std	0 days 00:47:51.967876	1.418966	5.940839	8331.725355
min	0 days 00:00:00	0.000000	21.012000	84014.252000
25%	0 days 00:03:49	0.000000	36.588000	84087.724000
50%	0 days 00:22:58	0.200000	39.928000	100837.940000
75%	0 days 00:58:38	1.000000	43.836000	100864.708000
max	0 days 13:02:42	12.500000	64.516000	100904.192000

twchi-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6	6.000000	6.000000	6.000000
mean	0 days 00:10:16.333333	1.483333	41.636667	98060.518000
std	0 days 00:13:13.268344	1.227056	6.002969	6842.062535
min	0 days 00:00:40	0.300000	31.196000	84094.252000
25%	0 days 00:00:49	0.550000	40.030000	100834.662000
50%	0 days 00:03:31.500000	1.250000	42.996000	100849.028000
75%	0 days 00:17:30.500000	2.025000	44.279000	100860.622000
max	0 days 00:31:50	3.500000	48.884000	100876.440000

twcoh-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	7620	7620.000000	7620.000000	7620.000000
mean	0 days 00:45:03.941076	0.931890	40.602969	92051.391410
std	0 days 01:04:53.740665	1.482979	6.494754	8444.836492
min	0 days 00:00:00	0.000000	0.000000	0.000000
25%	0 days 00:02:03	0.000000	36.356000	84083.491000
50%	0 days 00:19:43	0.300000	40.094000	84105.324000
75%	0 days 01:04:31.500000	1.300000	44.412000	100860.291000
max	0 days 15:35:31	29.000000	68.484000	100901.460000

twcsc-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6061	6061.000000	6061.000000	6061.000000
mean	0 days 00:46:59.775944	0.766029	41.609517	92597.825228
std	0 days 01:07:10.353304	1.342303	6.686711	8388.101676
min	0 days 00:00:00	0.000000	20.712000	84014.252000
25%	0 days 00:03:44	0.000000	37.184000	84084.088000
50%	0 days 00:26:08	0.200000	41.312000	100815.384000
75%	0 days 01:06:43	1.000000	45.640000	100860.784000
max	0 days 21:03:24	25.300000	74.492000	100893.512000

twctx-html	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6688	6688.000000	6688.000000	6688.000000
mean	0 days 00:44:31.546949	0.724940	40.468510	92066.971871
std	0 days 00:55:13.246938	1.347925	6.171599	8379.099236
min	0 days 00:00:00	0.000000	16.700000	83989.668000
25%	0 days 00:04:54.250000	0.000000	36.487000	84084.712000
50%	0 days 00:26:51	0.200000	40.156000	84103.450000
75%	0 days 01:05:55.250000	0.800000	44.197000	100861.461000
max	0 days 20:42:06	17.000000	72.108000	100895.256000

## A Appendix B Session Size WebKitWeb

bhdcal-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1641	1641.000000	1641.000000	1641.000000
mean	0 days 00:47:59.734917	6.607861	269.074430	93265.316458
std	0 days 01:08:53.540465	15.080158	79.533106	8394.958052
min	0 days 00:00:01	0.100000	137.212000	84677.552000
25%	0 days 00:03:14	0.400000	207.888000	85007.840000
50%	0 days 00:24:17	1.200000	244.628000	85514.572000
75%	0 days 01:10:41	6.600000	324.044000	101783.220000
max	0 days 15:26:59	174.000000	751.600000	102977.948000

bhnal-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	33	33.000000	33.000000	33.000000
mean	0 days 01:11:32.878787	1.060606	278.651030	94285.292485
std	0 days 01:35:45.949952	1.561638	112.875977	8534.306397
min	0 days 00:01:27	0.100000	151.680000	84767.788000
25%	0 days 00:16:56	0.300000	193.936000	85009.672000
50%	0 days 00:43:43	0.500000	225.848000	101715.160000
75%	0 days 01:16:55	1.400000	372.560000	101869.692000
max	0 days 08:14:48	8.800000	544.792000	102540.112000

bhnca-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	65	65.000000	65.000000	65.000000
mean	0 days 00:36:22.800000	4.886154	269.882462	93346.691138
std	0 days 00:46:35.528763	7.096740	93.165616	8475.284030
min	0 days 00:00:09	0.100000	161.472000	84757.680000
25%	0 days 00:02:26	0.400000	197.236000	84983.564000
50%	0 days 00:12:17	1.300000	249.900000	85846.312000
75%	0 days 00:56:44	5.500000	321.364000	101823.024000
max	0 days 03:22:28	27.400000	644.460000	102331.516000

bhnfl-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	19	19.000000	19.000000	19.000000
mean	0 days 00:21:37.842105	9.536842	260.241474	93034.752421
std	0 days 00:36:04.607489	19.080916	59.047020	8543.206687
min	0 days 00:00:02	0.200000	178.900000	84961.856000
25%	0 days 00:01:35	1.150000	227.052000	85119.464000
50%	0 days 00:04:21	4.700000	256.548000	85527.220000
75%	0 days 00:19:50.500000	7.250000	289.726000	101728.210000
max	0 days 01:58:12	83.500000	415.448000	102042.076000

bhnoh-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	61	61.000000	61.000000	61.000000
mean	0 days 01:02:15.262295	3.540984	277.482098	92011.115344
std	0 days 01:14:50.980976	7.663276	105.821296	8390.983725
min	0 days 00:00:07	0.100000	166.048000	84708.428000
25%	0 days 00:12:20	0.300000	201.144000	84990.752000
50%	0 days 00:39:16	0.500000	240.728000	85292.432000
75%	0 days 01:27:28	2.300000	337.684000	101810.632000
max	0 days 07:01:28	34.100000	761.628000	103177.336000

blngmt-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	387	387.000000	387.000000	387.000000
mean	0 days 00:44:46.739018	5.257106	274.923917	93677.883370
std	0 days 00:54:59.482207	11.680765	88.782132	8422.266642
min	0 days 00:00:00	0.000000	22.196000	84662.068000
25%	0 days 00:02:54	0.400000	210.560000	85005.990000
50%	0 days 00:24:07	0.900000	244.248000	101599.704000
75%	0 days 01:09:42	5.600000	336.486000	101816.084000
max	0 days 05:06:16	112.000000	978.920000	103313.068000

bodcma-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	757	757.000000	757.000000	757.000000
mean	0 days 00:48:36.417437	4.956803	268.058225	93761.174880
std	0 days 01:04:42.106945	13.092361	83.362128	8397.483852
min	0 days 00:00:01	0.000000	85.064000	84523.628000
25%	0 days 00:04:42	0.300000	203.056000	85019.428000
50%	0 days 00:26:18	0.800000	243.484000	101589.704000
75%	0 days 01:06:20	3.600000	328.416000	101798.500000
max	0 days 10:55:42	148.000000	686.072000	102851.056000

dldctx-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1175	1175.000000	1175.000000	1175.000000
mean	0 days 00:49:08.815319	5.305957	275.398203	93220.453699
std	0 days 01:06:22.008064	13.405384	91.147089	8387.127933
min	0 days 00:00:00	0.000000	22.916000	84737.112000
25%	0 days 00:03:42	0.300000	207.588000	85004.898000
50%	0 days 00:27:26	0.900000	246.172000	85510.376000
75%	0 days 01:10:43.500000	4.500000	335.568000	101785.870000
max	0 days 14:03:39	193.000000	794.712000	102853.664000

edprmn-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	484	484.000000	484.000000	484.000000
mean	0 days 00:54:31.832644	3.075826	307.553843	94485.551744
std	0 days 01:11:39.732531	8.593778	79.035835	8374.149546
min	0 days 00:00:00	0.000000	118.788000	84880.396000
25%	0 days 00:09:14.750000	0.300000	233.405000	85473.506000
50%	0 days 00:37:29	0.600000	324.846000	101871.342000
75%	0 days 01:12:21	1.800000	360.830000	102252.340000
max	0 days 14:01:57	110.000000	584.544000	102612.116000

knwdmi-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1197	1197.000000	1197.000000	1197.000000
mean	0 days 00:56:20.769423	4.304511	308.183479	93711.516999
std	0 days 01:11:11.558274	11.838161	85.519402	8390.990125
min	0 days 00:00:00	0.000000	22.752000	84603.540000
25%	0 days 00:05:20	0.300000	231.296000	85440.824000
50%	0 days 00:32:53	0.700000	318.392000	85899.792000
75%	0 days 01:18:14	3.000000	361.372000	102196.928000
max	0 days 10:18:51	157.000000	873.304000	103412.164000

ladcca-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1405	1405.000000	1405.000000	1405.000000
mean	0 days 00:37:44.374377	5.675658	264.299693	93489.357469
std	0 days 00:51:18.488127	12.728386	79.433408	8400.606143
min	0 days 00:00:00	0.000000	22.764000	84299.084000
25%	0 days 00:03:04	0.400000	206.336000	84996.864000
50%	0 days 00:20:20	1.000000	243.328000	101279.356000
75%	0 days 00:56:15	5.400000	312.024000	101787.456000
max	0 days 14:17:15	125.000000	690.820000	102754.392000

mddcwi-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1174	1174.000000	1174.000000	1174.000000
mean	0 days 00:54:27.664395	3.966440	308.771567	93703.389761
std	0 days 01:06:51.603549	11.909432	86.137851	8395.924431
min	0 days 00:00:01	0.000000	159.460000	84836.184000
25%	0 days 00:05:59	0.300000	232.573000	85414.961000
50%	0 days 00:31:56	0.800000	320.204000	85930.746000
75%	0 days 01:17:12	2.800000	364.063000	102202.970000
max	0 days 07:29:29	171.000000	800.224000	102883.796000

nvdctn-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1100	1100.000000	1100.000000	1100.000000
mean	0 days 00:51:39.499090	5.528636	272.165655	93515.126298
std	0 days 01:14:14.436307	13.528068	84.463664	8378.531494
min	0 days 00:00:01	0.000000	74.036000	84499.972000
25%	0 days 00:02:50	0.300000	210.856000	85040.900000
50%	0 days 00:26:23	1.000000	247.184000	101462.920000
75%	0 days 01:09:48	6.400000	329.754000	101781.689000
max	0 days 11:03:04	189.000000	901.456000	103204.112000

pldcor-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	617	617.000000	617.000000	617.000000
mean	0 days 00:38:47.150729	5.044408	292.155896	93418.637433
std	0 days 00:55:32.465155	10.906144	89.670811	8401.566952
min	0 days 00:00:00	0.000000	25.996000	84137.212000
25%	0 days 00:02:09	0.400000	222.672000	85047.452000
50%	0 days 00:19:07	1.100000	263.728000	85655.872000
75%	0 days 00:55:46	5.300000	350.596000	101834.576000
max	0 days 10:31:02	125.000000	697.316000	102571.984000

renonv-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	463	463.000000	463.000000	463.000000
mean	0 days 00:45:09.572354	4.349028	305.243127	94012.408268
std	0 days 00:59:55.040315	10.439120	81.692878	8395.393997
min	0 days 00:00:01	0.000000	136.740000	84711.100000
25%	0 days 00:04:00	0.400000	229.926000	85456.474000
50%	0 days 00:26:20	1.000000	315.000000	101835.508000
75%	0 days 01:01:49.500000	4.700000	358.910000	102201.874000
max	0 days 07:46:35	129.000000	654.896000	102728.624000

sldcla-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	367	367.000000	367.000000	367.000000
mean	0 days 00:52:02.321525	3.447684	308.282441	93665.601439
std	0 days 01:05:07.477689	9.627144	95.466018	8427.520111
min	0 days 00:00:02	0.100000	165.548000	84807.784000
25%	0 days 00:07:46.500000	0.300000	226.758000	85204.854000
50%	0 days 00:32:44	0.600000	314.456000	101577.676000
75%	0 days 01:08:19	2.500000	362.068000	102112.082000
max	0 days 09:19:37	98.500000	928.156000	102851.420000



sldcmo-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1980	1980.000000	1980.000000	1980.000000
mean	0 days 00:55:38.648989	3.693030	316.468954	93539.294240
std	0 days 01:08:03.930234	9.488692	87.851164	8381.376493
min	0 days 00:00:01	0.100000	23.804000	84398.404000
25%	0 days 00:07:43.250000	0.300000	238.434000	85440.543000
50%	0 days 00:32:55	0.700000	328.272000	85812.378000
75%	0 days 01:16:59.250000	2.800000	368.862000	102216.639000
max	0 days 07:57:31	140.000000	904.712000	103012.388000

slotca-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	419	419.000000	419.000000	419.000000
mean	0 days 00:34:15.622911	6.990215	265.624086	92961.341289
std	0 days 00:41:34.817834	16.063384	80.754510	8384.820665
min	0 days 00:00:00	0.000000	39.020000	84303.168000
25%	0 days 00:02:49.500000	0.400000	208.816000	85002.490000
50%	0 days 00:19:21	1.300000	237.424000	85427.164000
75%	0 days 00:53:00	5.950000	320.490000	101763.350000
max	0 days 04:48:31	137.000000	567.296000	102545.756000

spdcsc-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1815	1815.000000	1815.000000	1815.000000
mean	0 days 00:56:59.471625	4.009311	305.484666	93807.664732
std	0 days 01:06:11.555733	10.265469	89.137759	8401.546899
min	0 days 00:00:00	0.000000	22.492000	84135.636000
25%	0 days 00:06:08.500000	0.300000	227.934000	85413.012000
50%	0 days 00:36:52	0.700000	313.952000	101679.744000
75%	0 days 01:24:12	2.800000	362.102000	102202.358000
max	0 days 09:27:02	170.000000	859.972000	103375.116000

twcca-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	4882	4882.000000	4882.000000	4882.000000
mean	0 days 00:37:10.723473	5.804056	261.173032	93298.046357
std	0 days 00:47:27.228777	13.116683	77.443608	8385.958011
min	0 days 00:00:00	0.000000	22.268000	84135.628000
25%	0 days 00:02:59.250000	0.400000	202.723000	84998.580000
50%	0 days 00:20:36	1.100000	235.218000	85530.334000
75%	0 days 00:56:59.250000	5.200000	319.067000	101773.449000
max	0 days 12:57:32	162.000000	702.176000	102954.784000

twchi-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	7	7.000000	7.000000	7.000000
mean	0 days 00:08:11.714285	34.500000	255.581143	96977.096571
std	0 days 00:12:34.734327	33.583428	91.738284	8324.749851
min	0 days 00:00:01	1.000000	140.528000	84709.300000
25%	0 days 00:00:02.500000	3.400000	192.376000	93168.260000
50%	0 days 00:00:21	30.200000	236.616000	101737.256000
75%	0 days 00:12:51.500000	60.750000	323.356000	101980.632000
max	0 days 00:31:12	82.000000	380.460000	102095.336000

twcoh-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	7029	7029.000000	7029.000000	7029.000000
mean	0 days 00:48:33.576753	6.037018	268.474773	93314.015463
std	0 days 01:06:09.342102	14.052157	84.220805	8394.765584
min	0 days 00:00:00	0.000000	22.172000	84135.768000
25%	0 days 00:02:56	0.300000	207.852000	85006.232000
50%	0 days 00:25:26	1.000000	243.740000	85531.004000
75%	0 days 01:10:18	5.500000	326.600000	101786.200000
max	0 days 15:30:52	197.000000	2158.540000	106445.680000

twcsc-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6027	6027.000000	6027.000000	6027.000000
mean	0 days 00:46:36.191969	5.435026	278.392985	93518.459964
std	0 days 01:02:49.906873	12.562265	92.701697	8396.009497
min	0 days 00:00:00	0.000000	22.292000	84135.760000
25%	0 days 00:03:50	0.400000	208.964000	85048.218000
50%	0 days 00:26:11	0.900000	243.228000	86769.572000
75%	0 days 01:06:38.500000	5.000000	343.698000	101835.804000
max	0 days 21:02:10	178.000000	1133.824000	103563.788000

twctx-WebKitWeb	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6693	6693.000000	6693.000000	6693.000000
mean	0 days 00:44:14.776632	4.929777	268.298349	93506.322511
std	0 days 00:55:06.150575	11.754724	82.184429	8468.281196
min	0 days 00:00:00	0.000000	0.000000	0.000000
25%	0 days 00:04:42	0.400000	202.692000	85032.016000
50%	0 days 00:26:38	0.900000	242.516000	101474.100000
75%	0 days 01:05:19	3.900000	329.084000	101805.592000
max	0 days 20:40:25	165.000000	884.992000	102890.868000

## A Appendix C Session Size WebKitNetwork

bhdcal-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1610	1610.000000	1610.000000	1610.000000
mean	0 days 00:48:43.219875	0.503913	32.182484	92961.125610
std	0 days 01:09:12.456579	1.902915	1.466063	8391.175123
min	0 days 00:00:00	0.000000	20.756000	83987.668000
25%	0 days 00:03:42.250000	0.000000	31.324000	84640.616000
50%	0 days 00:25:38	0.000000	31.610000	84779.884000
75%	0 days 01:11:07.750000	0.200000	33.115000	101376.107000
max	0 days 15:27:17	30.000000	42.004000	101614.444000

bhnal-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	33	33.000000	33.000000	33.000000
mean	0 days 01:11:42.878787	0.030303	32.657333	94335.098182
std	0 days 01:35:45.949952	0.123705	1.205251	8434.521188
min	0 days 00:01:37	0.000000	30.964000	84501.300000
25%	0 days 00:17:06	0.000000	31.668000	84706.148000
50%	0 days 00:43:53	0.000000	32.348000	101417.828000
75%	0 days 01:17:05	0.000000	33.532000	101483.368000
max	0 days 08:14:58	0.700000	35.832000	101616.484000

bhnca-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	66	66.000000	66.000000	66.000000
mean	0 days 00:36:05.787878	0.383333	32.67200	93304.580606
std	0 days 00:46:28.067638	0.955725	2.00823	8452.775126
min	0 days 00:00:06	0.000000	30.80400	84501.300000
25%	0 days 00:02:39.250000	0.000000	31.53100	84706.148000
50%	0 days 00:12:03	0.000000	31.71600	101352.292000
75%	0 days 00:56:40.750000	0.200000	33.45100	101469.029000
max	0 days 03:22:45	4.800000	42.81600	101491.560000

bhnfl-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	18	18.000000	18.000000	18.000000
mean	0 days 00:23:02.611111	0.633333	31.888889	91152.795778
std	0 days 00:37:16.993758	1.855992	0.783675	8385.614870
min	0 days 00:00:01	0.000000	31.016000	84509.540000
25%	0 days 00:02:04	0.000000	31.432000	84706.148000
50%	0 days 00:04:59	0.100000	31.802000	84706.148000
75%	0 days 00:22:34.250000	0.375000	32.112000	101352.296000
max	0 days 01:59:35	8.000000	34.576000	101483.368000

bhnoh-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	63	63.000000	63.000000	63.000000
mean	0 days 01:00:36.015873	0.292063	33.108635	92106.044889
std	0 days 01:14:28.233823	0.808084	1.572336	8413.716806
min	0 days 00:00:07	0.000000	31.032000	84575.076000
25%	0 days 00:10:13	0.000000	31.908000	84640.612000
50%	0 days 00:38:37	0.000000	33.000000	84706.152000
75%	0 days 01:26:59	0.050000	33.662000	101418.852000
max	0 days 07:01:48	4.700000	38.200000	101491.564000

blngmt-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	387	387.000000	387.000000	387.000000
mean	0 days 00:44:54.524547	0.413178	32.581984	92458.109881
std	0 days 00:55:01.386454	1.399632	1.493820	8380.114157
min	0 days 00:00:01	0.000000	30.572000	84435.772000
25%	0 days 00:02:49.500000	0.000000	31.402000	84576.108000
50%	0 days 00:24:18	0.000000	32.000000	84721.516000
75%	0 days 01:09:52.500000	0.200000	33.506000	101353.324000
max	0 days 05:06:25	14.000000	38.980000	101679.980000

bodcma-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	766	766.000000	766.000000	766.000000
mean	0 days 00:47:42.869451	0.490470	32.181321	93110.149285
std	0 days 01:04:45.926109	1.720526	2.319433	8389.902331
min	0 days 00:00:00	0.000000	20.756000	83987.668000
25%	0 days 00:03:53.250000	0.000000	31.348000	84640.616000
50%	0 days 00:25:38	0.000000	31.640000	101212.986000
75%	0 days 01:06:07.250000	0.100000	32.290000	101417.832000
max	0 days 10:56:16	16.000000	82.524000	101679.976000

dldctx-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1174	1174.000000	1174.000000	1174.000000
mean	0 days 00:49:19.776831	0.395486	32.092501	92776.283632
std	0 days 01:06:30.947358	1.404986	1.870823	8388.010846
min	0 days 00:00:00	0.000000	20.752000	84061.444000
25%	0 days 00:03:50.250000	0.000000	31.292000	84577.129000
50%	0 days 00:27:27.500000	0.000000	31.532000	84710.516000
75%	0 days 01:11:11	0.200000	32.428000	101353.320000
max	0 days 14:04:07	15.500000	71.604000	101576.552000

edprmn-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	490	490.000000	490.000000	490.000000
mean	0 days 00:53:59.983673	0.284490	34.036555	92695.324735
std	0 days 01:11:36.222713	0.947823	1.864289	8383.613674
min	0 days 00:00:00	0.000000	21.800000	84583.224000
25%	0 days 00:09:16.250000	0.000000	32.448000	84730.732000
50%	0 days 00:36:04	0.000000	34.196000	84828.518000
75%	0 days 01:10:47	0.100000	34.700000	101507.944000
max	0 days 14:02:29	7.500000	42.148000	101639.020000

knwdmi-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1196	1196.000000	1196.000000	1196.000000
mean	0 days 00:56:42.188963	0.295151	34.223070	92974.769452
std	0 days 01:11:17.367918	1.632866	1.832524	8393.739773
min	0 days 00:00:00	0.000000	21.800000	83987.684000
25%	0 days 00:05:41.750000	0.000000	32.535000	84788.068000
50%	0 days 00:32:51	0.000000	34.332000	84904.294000
75%	0 days 01:18:38	0.100000	34.977000	101565.288000
max	0 days 10:19:25	48.000000	44.556000	101762.920000

ladcca-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1407	1407.000000	1407.000000	1407.000000
mean	0 days 00:38:02.893390	0.508102	33.524861	92964.502465
std	0 days 00:54:53.590329	1.569120	2.092781	8391.130483
min	0 days 00:00:00	0.000000	20.752000	83987.668000
25%	0 days 00:03:03	0.000000	31.820000	84576.104000
50%	0 days 00:20:29	0.000000	33.332000	84771.688000
75%	0 days 00:56:29.500000	0.200000	33.992000	101353.320000
max	0 days 14:17:46	16.000000	44.060000	101615.464000

mddcwi-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1185	1185.000000	1185.000000	1185.000000
mean	0 days 00:53:42.642194	0.383713	34.304354	92782.586015
std	0 days 01:06:35.849268	1.510161	2.098200	8381.676242
min	0 days 00:00:00	0.000000	21.796000	83987.684000
25%	0 days 00:05:31	0.000000	32.560000	84788.072000
50%	0 days 00:31:06	0.000000	34.324000	84889.448000
75%	0 days 01:16:51	0.100000	35.016000	101565.288000
max	0 days 07:30:02	23.500000	46.588000	101763.052000

nvdctn-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1094	1094.000000	1094.000000	1094.000000
mean	0 days 00:52:00.544789	0.433547	32.360596	92956.821144
std	0 days 01:14:21.341947	1.631618	1.510220	8390.872779
min	0 days 00:00:00	0.000000	20.756000	84435.768000
25%	0 days 00:03:02.500000	0.000000	31.380000	84640.616000
50%	0 days 00:26:50	0.000000	31.724000	84820.840000
75%	0 days 01:10:17.750000	0.200000	33.382000	101417.832000
max	0 days 11:03:21	28.000000	43.848000	101645.160000

pldcor-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	608	608.000000	608.000000	608.000000
mean	0 days 00:39:13.812500	0.475822	32.509566	93434.078914
std	0 days 00:55:48.016129	1.561098	1.672544	8384.144046
min	0 days 00:00:01	0.000000	30.628000	84501.304000
25%	0 days 00:02:24.500000	0.000000	31.364000	84640.620000
50%	0 days 00:20:11.500000	0.000000	31.686000	101286.760000
75%	0 days 00:56:12	0.300000	33.405000	101417.832000
max	0 days 10:31:26	16.300000	41.452000	101614.444000

renonv-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	459	459.000000	459.000000	459.000000
mean	0 days 00:45:44.385620	0.422004	33.841333	92993.109429
std	0 days 01:00:07.492928	1.474594	1.659362	8400.467081
min	0 days 00:00:01	0.000000	30.840000	84296.492000
25%	0 days 00:04:03	0.000000	32.520000	84756.840000
50%	0 days 00:26:39	0.000000	33.296000	84923.240000
75%	0 days 01:02:26.500000	0.200000	34.670000	101565.284000
max	0 days 07:46:50	12.000000	42.968000	101761.892000

sldcla-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	362	362.000000	362.000000	362.000000
mean	0 days 00:52:57.088397	0.191436	32.780144	92487.885558
std	0 days 01:05:19.394376	0.728113	1.737135	8385.602725
min	0 days 00:00:01	0.000000	23.396000	84444.012000
25%	0 days 00:09:29.500000	0.000000	31.393000	84583.276000
50%	0 days 00:33:53	0.000000	32.976000	84706.668000
75%	0 days 01:09:53.750000	0.100000	33.508000	101359.464000
max	0 days 09:19:54	9.000000	41.180000	101548.908000

sldcmo-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1974	1974.000000	1974.000000	1974.000000
mean	0 days 00:56:19.406788	0.302736	34.454014	93122.249777
std	0 days 01:08:20.245841	1.238855	1.836120	8392.444244
min	0 days 00:00:00	0.000000	21.796000	84296.624000
25%	0 days 00:08:24.250000	0.000000	32.732000	84788.072000
50%	0 days 00:33:40.500000	0.000000	34.420000	84919.276000
75%	0 days 01:18:14	0.100000	35.222000	101565.288000
max	0 days 07:58:30	19.200000	45.156000	101696.360000

slotca-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	421	421.000000	421.000000	421.000000
mean	0 days 00:33:58.508313	0.677910	32.083658	92918.673701
std	0 days 00:41:36.883165	2.216478	1.542743	8403.845534
min	0 days 00:00:00	0.000000	20.756000	83987.668000
25%	0 days 00:02:46	0.000000	31.316000	84584.304000
50%	0 days 00:19:08	0.000000	31.564000	84782.952000
75%	0 days 00:52:49	0.300000	32.140000	101417.836000
max	0 days 04:48:42	21.500000	40.276000	101615.464000

spdcsc-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	1834	1834.000000	1834.000000	1834.000000
mean	0 days 00:56:29.835877	0.356270	34.441058	93199.903531
std	0 days 01:06:11.147577	1.267452	1.873555	8392.694716
min	0 days 00:00:00	0.000000	30.684000	84296.488000
25%	0 days 00:05:42	0.000000	32.652000	84788.068000
50%	0 days 00:35:56	0.000000	34.408000	101327.670000
75%	0 days 01:23:28	0.100000	35.200000	101565.288000
max	0 days 09:27:37	15.000000	44.336000	101773.156000

twcca-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	4860	4860.000000	4860.000000	4860.000000
mean	0 days 00:37:26.970576	0.488395	32.194111	92859.917594
std	0 days 00:47:35.838528	1.668407	1.593251	8387.721985
min	0 days 00:00:00	0.000000	20.752000	83987.668000
25%	0 days 00:03:14	0.000000	31.396000	84706.152000
50%	0 days 00:20:52	0.000000	31.624000	84771.692000
75%	0 days 00:57:28.250000	0.200000	32.478000	101483.368000
max	0 days 12:58:06	36.000000	69.364000	101614.444000

twchi-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6	6.0000	6.000000	6.000000
mean	0 days 00:10:01.333333	0.5500	31.722667	95805.108000
std	0 days 00:13:13.268344	0.6253	0.516038	8641.901505
min	0 days 00:00:25	0.0000	31.140000	84648.808000
25%	0 days 00:00:34	0.0250	31.410000	88806.238000
50%	0 days 00:03:16.500000	0.3500	31.680000	101315.404000
75%	0 days 00:17:15.500000	1.0500	31.839000	101401.444000
max	0 days 00:31:35	1.4000	32.624000	101484.392000

twcoh-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6991	6991.000000	6991.000000	6991.000000
mean	0 days 00:44:39.496352	0.775039	32.245519	93004.548110
std	0 days 01:05:13.783687	2.326649	1.834341	8391.017793
min	0 days 00:00:00	0.000000	20.352000	83987.536000
25%	0 days 00:01:21	0.000000	31.316000	84640.616000
50%	0 days 00:19:20	0.000000	31.600000	84845.420000
75%	0 days 01:03:41.500000	0.500000	33.056000	101417.832000
max	0 days 15:32:32	64.000000	75.076000	101615.468000

twcsc-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6069	6069.000000	6069.000000	6069.000000
mean	0 days 00:46:54.089306	0.443121	32.358817	92979.545029
std	0 days 01:07:15.622491	1.489099	1.550216	8390.399349
min	0 days 00:00:00	0.000000	20.788000	83987.664000
25%	0 days 00:03:44	0.000000	31.520000	84654.952000
50%	0 days 00:25:58	0.000000	31.836000	84844.388000
75%	0 days 01:06:21	0.200000	33.124000	101456.744000
max	0 days 21:02:42	27.000000	55.980000	101682.020000

twctx-WebKitNet	ELAPSED	CPU%	RSS(mb)	SIZE(mb)
count	6721	6721.000000	6721.000000	6721.000000
mean	0 days 00:44:08.644100	0.423032	32.083319	93037.348626
std	0 days 00:55:04.623253	1.584696	1.734892	8389.790698
min	0 days 00:00:00	0.000000	20.788000	83987.664000
25%	0 days 00:04:38	0.000000	31.388000	84640.616000
50%	0 days 00:26:24	0.000000	31.616000	100764.880000
75%	0 days 01:05:29	0.100000	32.048000	101417.832000
max	0 days 20:41:36	33.000000	85.668000	101751.652000



## A Appendix D Session Size - Total Results

RDC	2.11 RSS AVE	2.11 RSS STD	2.16 RSS AVE	2.16 RSS STD
bhdcal	479.125	269.773	342.985	79.533
bhnal	N/A	N/A	354.572	112.875
bhnca	N/A	N/A	344.740	93.165
bhnfl	N/A	N/A	331.883	59.047
bhnoh	N/A	N/A	352.127	105.821
blngmt	741.827	506.062	350.391	88.782
bodcma	537.107	307.470	341.286	83.362
dldctx	484.178	295.350	349.107	91.147
edprmn	687.757	875.313	385.116	79.035
knwdmi	742.129	730.700	386.866	85.519
ladcca	450.936	244.823	342.854	79.433
mddewi	871.828	697.919	387.004	86.137
nvdctn	581.608	351.990	346.399	84.463
pldcor	815.620	733.513	367.257	89.670
renonv	968.266	643.358	381.890	81.692
sldcla	680.787	384.019	385.213	95.466
sldcmo	991.308	681.528	396.143	87.851
slotca	517.918	254.689	337.082	80.754
spdcsc	747.331	744.264	385.366	89.137
twcca	515.805	255.678	333.789	77.443
twchi	N/A	N/A	328.940	91.738
twcny.nydc	505.566	253.195	339.339	82.245
twcny.sydc	500.684	260.041	343.303	82.061
twcoh	499.298	253.252	341.323	84.220
twcsc	497.244	287.396	352.361	92.701
twctx	490.834	253.906	340.850	82.184

Table 2: 2.11 and 2.16 session sizes. All sizes in MB.