REPORT:

TermAppISONFT: Orkhestra Cross Test Resource Usage Summary

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```
## Loading required package: lattice

##
## Attaching package: 'BSDA'

## The following object is masked from 'package:datasets':
##
##     Orange

##  : starts:  Wed May 12 20:50:04 2021

## The following files in ../Test_Summary_Comparisons/csv match pattern "Resource_S
##    File = Test_Resource_Summary_D20201207.csv
##    File = Test_Resource_Summary_D20201208.csv
##    File = Test_Resource_Summary_D20201209_2.csv
##    File = Test_Resource_Summary_D20201209.csv
##    File = Test_Resource_Summary_D20201216.csv
##    File = Test_Resource_Summary_D20210115.csv
##    File = Test_Resource_Summary_D20210510.csv
##    File = Test_Resource_Summary_D20201207.csv with 12 rows added to total making
##    File = Test_Resource_Summary_D20201208.csv with 12 rows added to total making
##    File = Test_Resource_Summary_D20201209_2.csv with 12 rows added to total maki
##    File = Test_Resource_Summary_D20201209.csv with 12 rows added to total making
##    File = Test_Resource_Summary_D20201216.csv with 36 rows added to total making
##    File = Test_Resource_Summary_D20210115.csv with 12 rows added to total making
##    File = Test_Resource_Summary_D20210510.csv with 18 rows added to total making
```

1 Introduction

There are two elements to this cross test resource usage comparison report. The first compares the current test sessions test(s) estimate of resource and measure for each server group to the corresponding pooled estimates of the resource and measure for that group. The second compares each of the tests current and earlier tests individually for each resource and measure for each server group.

For the pooled comparison, the resource usage data for each resource type and measure of each server group (as grouped by the corresponding server classification file) for the current test(s) (the last set of tests by date) are isolated as individual tests and compared to the corresponding pooled resource usage distribution using a Welch modified two-sample t-test (`tsum.test`) based on the distribution parameters. Each resource type and measure, the estimation of the background usage (*Bias*, or load independent resource usage), for that resource and measure for the current test(s) are compared to the estimated pooled background usage of that resource type and measure. In a similar way, the estimation of the usage rate (*Rate*, or load dependant resource usage, the measure of the cost in terms of the corresponding resource for a rate of one customer arrival per second). For the pooling, the previous test results are filtered so that only the tests for which there is some confidence in the corresponding coefficient estimate are included in the pool statistics. A set resource usage coefficient estimate is included in the pooling of the corresponding p-value does not exceed $\alpha = 0.05$ (so that there is some confidence in the pooled coefficients). The *Bias* and *Rate* together with the actual customer arrival rate (*ArrivalRate*) give an estimation of the cost in terms of the resource being considered as $\text{TotalCost} = \text{Bias} + \text{ArrivalRate} * \text{Rate}$.

For each of the resource types and measures (Percent CPU Utilisation) and for each of the coefficient estimates (*Bias* and *Rate*), three `tsum.tests` are performed: One two-sided test to for differences in the corresponding distributions, and two one-sided tests, one to test for increases in the resource usage, and one to test for decreases in resource usage (of each of the current tests over pooled prior tests). These comparisons of the tests are ranked by the corresponding p-values. The items for which the p-value does not exceed the cut-off α value (0.05) are high-lighted by reporting them in a ranked table. are included in the corresponding comparison table. Up to the first 15 are included in an accompanying box-plot as well.

This high-lighting is intended to quickly bring outliers or significant changes in resource usage to the readers attention, but the second part of the report includes a full cross test comparison of current and earlier tests each server group, resource and measure, for both *Bias* and *Rate*.

These summary results have been taken from the analysis sections of the individual NFT sessions. For the *Rate* coefficient, only those results which are considered significant in the response of the resource usage to the applied load are included. The *Bias* parameter is included wherever there was some significance in the estimated intercept value.

The coefficients are determined from linear models regressing the resource usage onto the throughput observed. A model is generated for each server class in the server classification list for the specific project's server landscape. In each case, the resource usage is a measure of the resource usage, and these metrics are added up for all servers in the class. In addition, for the z/OS workload, the RMF measured CPU for each address space of interest is totalled and used as resource measure to regress onto the throughput observed (field `R791TCPU` of RMF record type 79 subtype one is used for this). A class is simply a group of servers intended to deliver the function to the application. The class name is intended to indicate the function provided (for example, `TFIM_CLIENT`). For each linear model, two coefficients are estimated. The Bias/Intercept is an estimate of the background resource usage, which is independent of the load applied. This load could be unrelated or overhead workload on a shared server or overhead workload on dedicated servers. For dedicated servers, this value is expected to be reasonably small as it should only reflect the overhead in managing and monitoring the workload. For shared servers, the value should ideally be reasonably low, and where this is the case, this indicates a reasonably controlled test environment (making the shared server behave like a dedicated server for the test duration). Where there is workload on a shared server/servers unrelated to the system under test during a test, the additional workload may confound the estimation of the Rate coefficient, making the required resource usage over or understated.

The *Rate* is the coefficient on the achieved load. This is usually the session rate or customer arrival rate, measure in customer arrivals per second. Depending on the NFT setup, a session would do either a chain of application functions on behalf of a single business/user-level function or may do a single function or operation. This distinction usually correlates to simulating end-users (multiple calls/operations within a session) or single function/call/operation within a session (system to system or device to device calls). In either case, the Rate coefficient is the session arrival rate achieved.

The interpretation of the *Rate* coefficient is that it is the resource cost in (one of) the appropriate metric for the server type, and hence is the estimated cost in terms that metric of a single session per second (or customer arrival per second).

2 Server classification from application landscape

```
## The following files in landscape match pattern "Server_Classification.*csv":
```

```
##    File = CMLEcoSystem_Server_Classification.csv
##    File = CMLEcoSystem_Server_Classification.csv with 5 rows added to total maki
```

Classification	Server	IP_Address	OSType	Description	Hardware_Support	Server_Support	Application_Support	SOURCE_FILE
LOAD	LOAD0	176.67.166.86	Linux	CML EcoSystem	Patrick Hayward	Patrick Hayward	Patrick Hayward	CMLEcoSystem_Server_Classific
LOAD	LOAD1	176.67.166.89	Linux	CML EcoSystem	Patrick Hayward	Patrick Hayward	Patrick Hayward	CMLEcoSystem_Server_Classific
MODEL	MODELAPP0	176.67.166.20	Linux	CML EcoSystem	Patrick Hayward	Patrick Hayward	Patrick Hayward	CMLEcoSystem_Server_Classific
MODEL	MODELAPP1	176.67.166.72	Linux	CML EcoSystem	Patrick Hayward	Patrick Hayward	Patrick Hayward	CMLEcoSystem_Server_Classific
NETWORK	NETWORK0	109.123.111.17	Linux	CML EcoSystem	Patrick Hayward	Patrick Hayward	Patrick Hayward	CMLEcoSystem_Server_Classific

3 Comparison of current tests to pooled earlier tests

The last test date in the summary data is used to delimit the prior tests from the tests in the last test session. This section compares the resource usage for each resource type and measure for each server group to the corresponding pooled reource usage and measire for the server group. The current test(s) are the tests performed on 2021-05-10. Resource uage metrics are pooled only where the corresponding p-value is demonstrates some confidence in the estimated coefficient.

3.1 Differences in resource usage

The following show the comparisons of the tests performed on 2021-05-10 as compared to the tests performed before this date. The table is ranked in increasing order of the p-values from the corresponding Welch Modified Two-Sample t-Test (two.sided), starting from server group where the resource usage distribution differences are the greatest. Results are only shown for which the p-value is less than or equal to the cutoff value (α = 0.05).

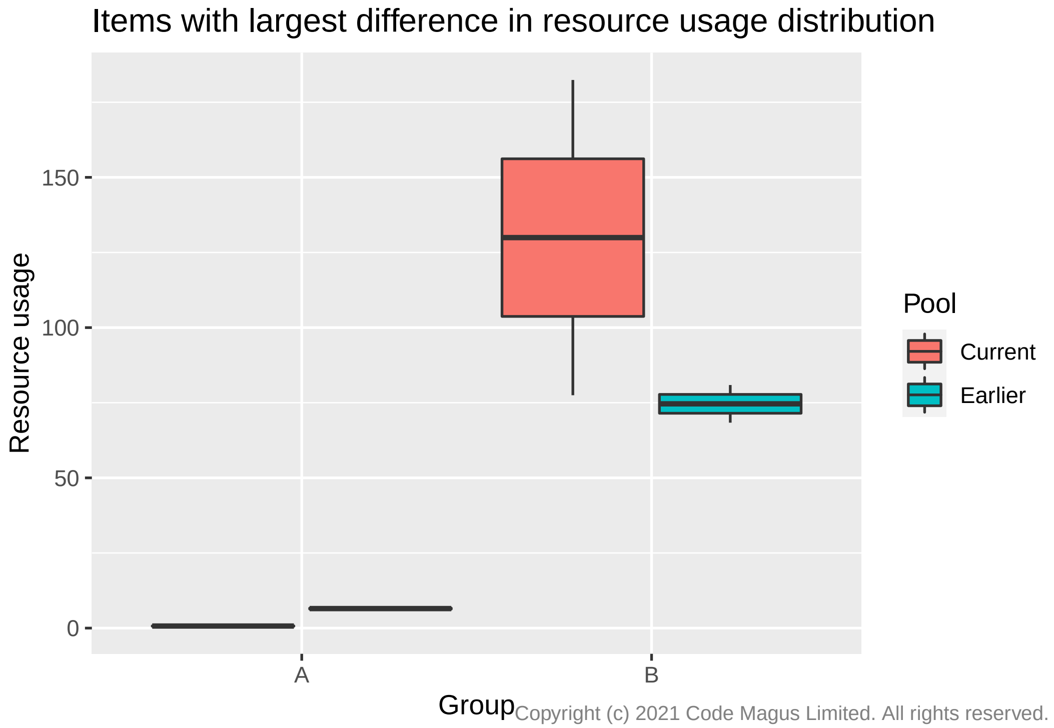
3.1.1 Test 1 - TermAppISO

3.1.1.1 Resource class: CPU

The following compares the resource usage differences from the test started at 2021-05-10 16:52:00 to the tests from previous test sessions.

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.d
LOAD	Rate	22	cpu.cpu.system.user	Percent single processor	0.680	0.066	613	6.495	0.166	0
MODEL	Bias	22	cpu.cpu.system.user	Percent single processor	129.953	26.227	613	74.630	3.134	0

```
## Loading required package: grid
```

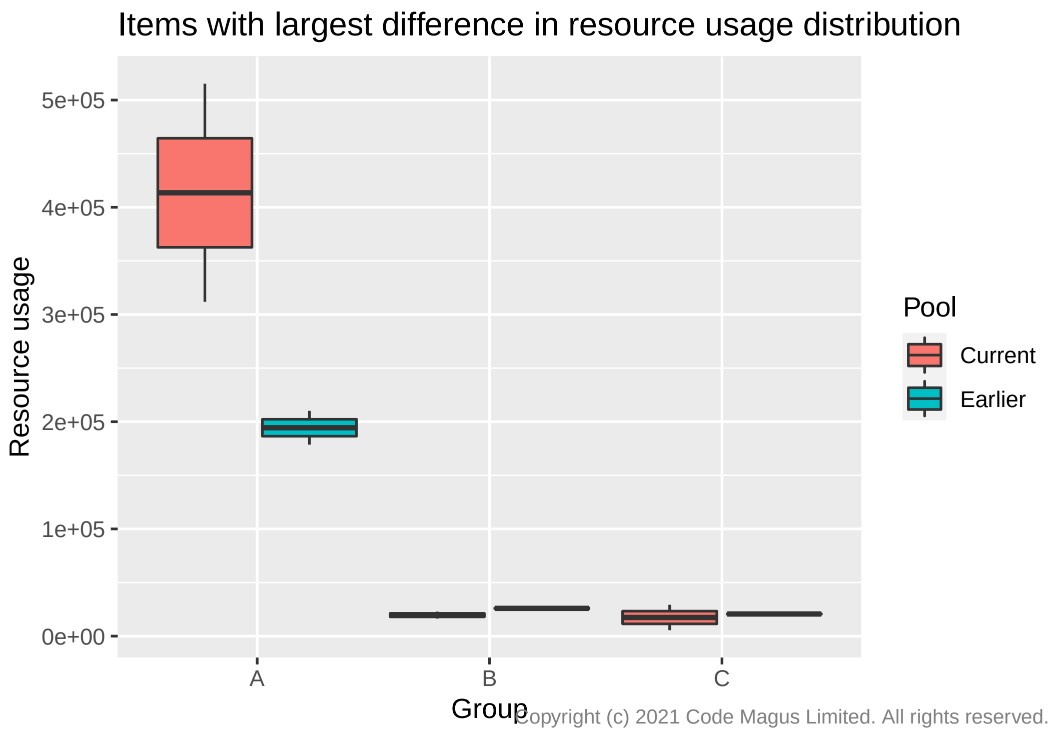


Key	Group
A	LOAD Rate Percent single processor CPU Usage
B	MODEL Bias Percent single processor CPU Usage

3.1.1.2 Resource class: Network

The following compares the resource usage differences from the test started at 2021-05-10 16:52:00 to the tests from previous test sessions.

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.d
LOAD	Bias	22	sent	bits per second	413513.78	50867.430	613	194358.86	7893.677	0.000
LOAD	Rate	22	sent	bits per second	19612.35	1623.789	613	25900.80	408.096	0.000
MODEL	Rate	22	recv	bits per second	17389.63	5929.025	612	20648.37	242.773	0.018



Key	Group
A	LOAD Bias bits per second Network Usage sent
B	LOAD Rate bits per second Network Usage sent
C	MODEL Rate bits per second Network Usage recv

3.2 Increases in resource usage

The following show the comparisons of the tests performed on 2021-05-10 as compared to the tests performed before this date. The table is ranked in increasing order of the p-values from the corresponding Welch Modified Two-Sample t-Test (greater), starting from server group where the resource usage increase is greatest. Results are only shown for which the p-value is less than or equal to the cutoff value ($\alpha = 0.05$).

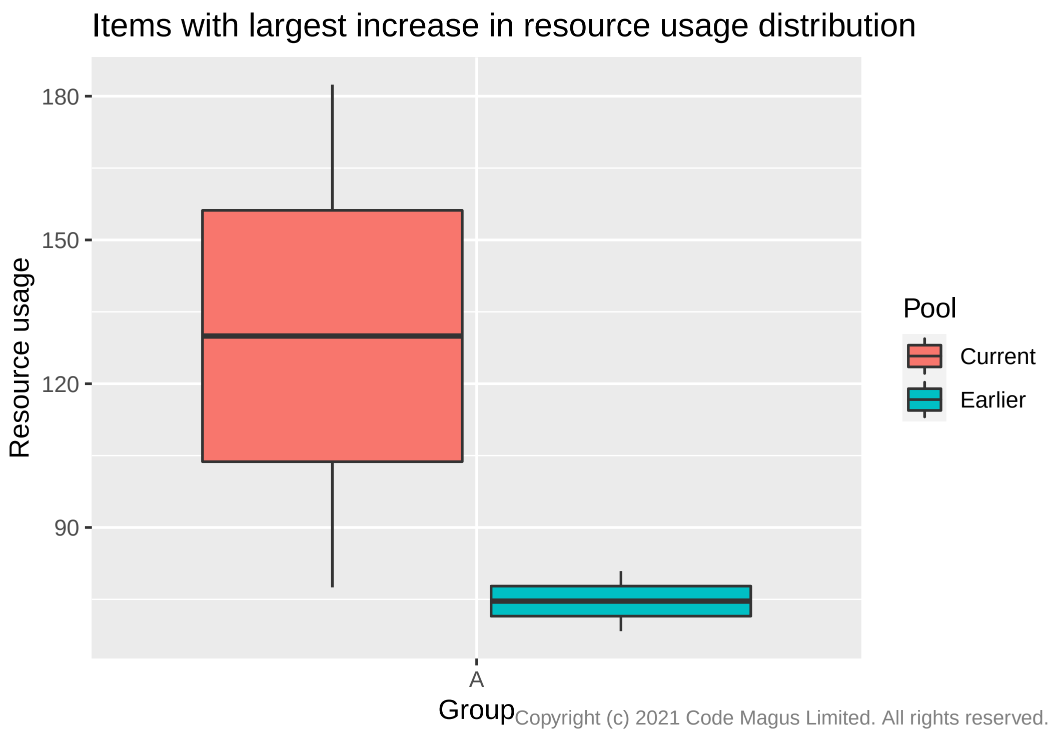
3.2.1 Test 1 - TermAppISO

3.2.1.1 Resource class: CPU

The following compares the resource usage increases from the test started at 2021-05-10 16:52:00 to the tests from previous test sessions.

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.g
MODEL	Bias	22	cpu.cpu.system.user	Percent single processor	129.953	26.227	613	74.63	3.134	0

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.g

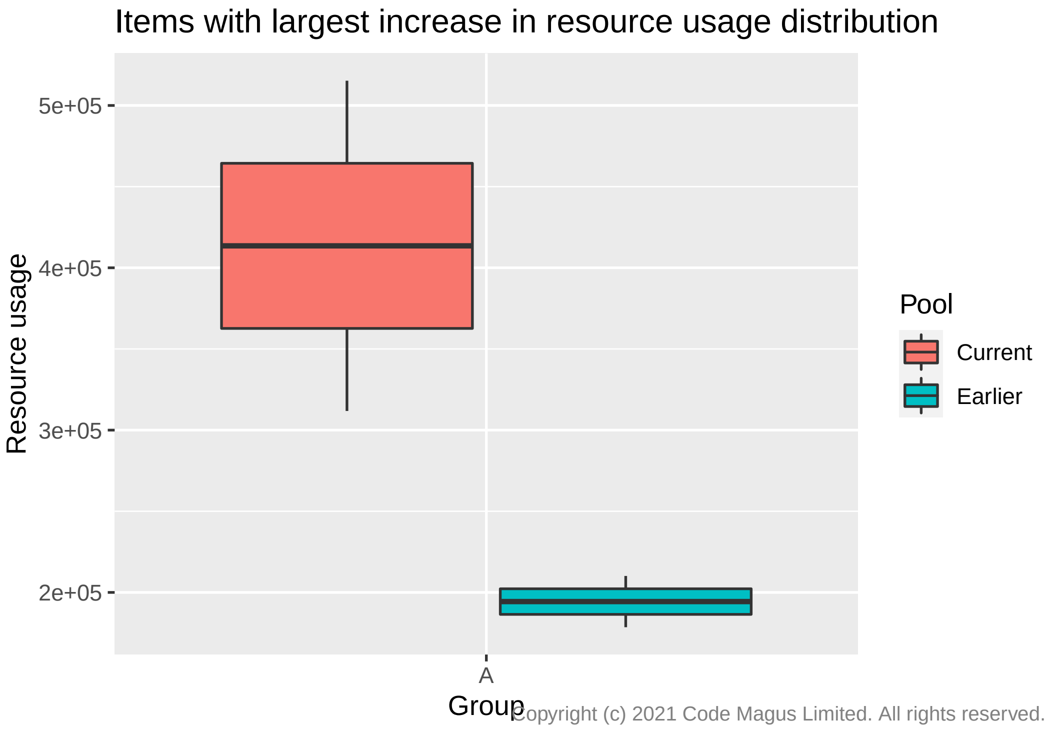


Key	Group
A	MODEL Bias Percent single processor CPU Usage

3.2.1.2 Resource class: Network

The following compares the resource usage increases from the test started at 2021-05-10 16:52:00 to the tests from previous test sessions.

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.g
LOAD	Bias	22	sent	bits per second	413513.8	50867.43	613	194358.9	7893.677	0



Key	Group
A	LOAD Bias bits per second Network Usage sent

3.3 Decreases in resource usage

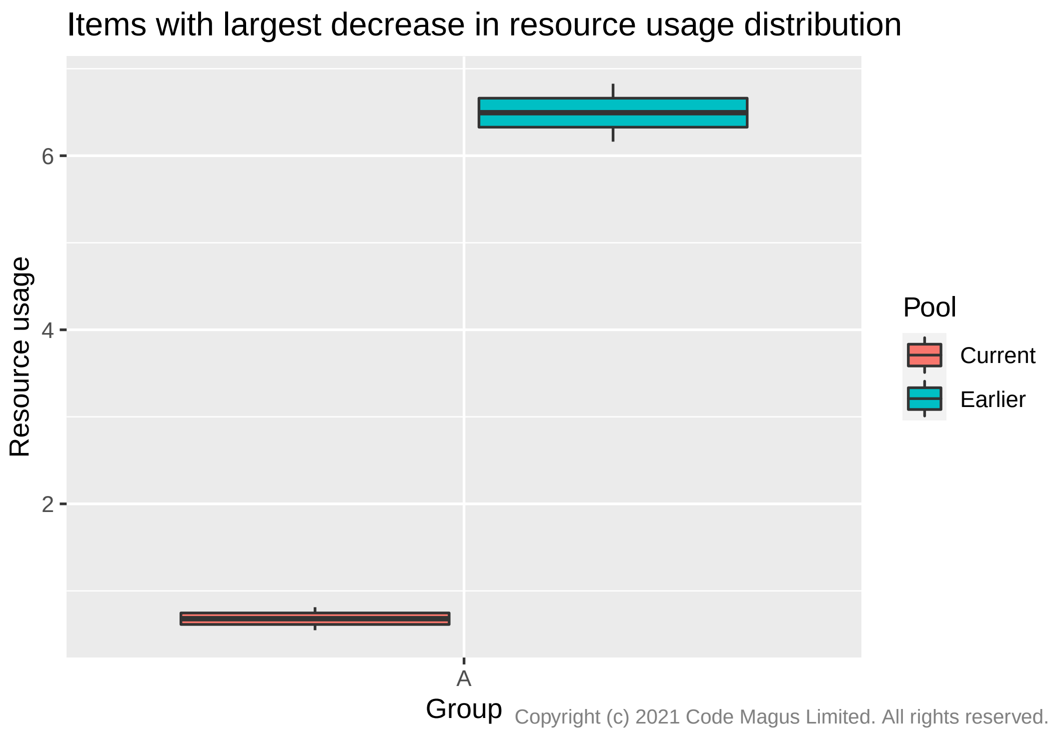
The following show the comparisons of the tests performed on 2021-05-10 as compared to the tests performed before this date. The table is ranked in increasing order of the p-values from the corresponding Welch Modified Two-Sample t-Test (less), starting from server group where the resource usage decrease is greatest. Results are only shown for which the p-value is less than or equal to the cutoff value ($\alpha = 0.05$).

3.3.1 Test 1 - TermAppISO

3.3.1.1 Resource class: CPU

The following compares the resource usage decreases from the test started at 2021-05-10 16:52:00 to the tests from previous test sessions.

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.l
LOAD	Rate	22	cpu.cpu.system.user	Percent single processor	0.68	0.066	613	6.495	0.166	0

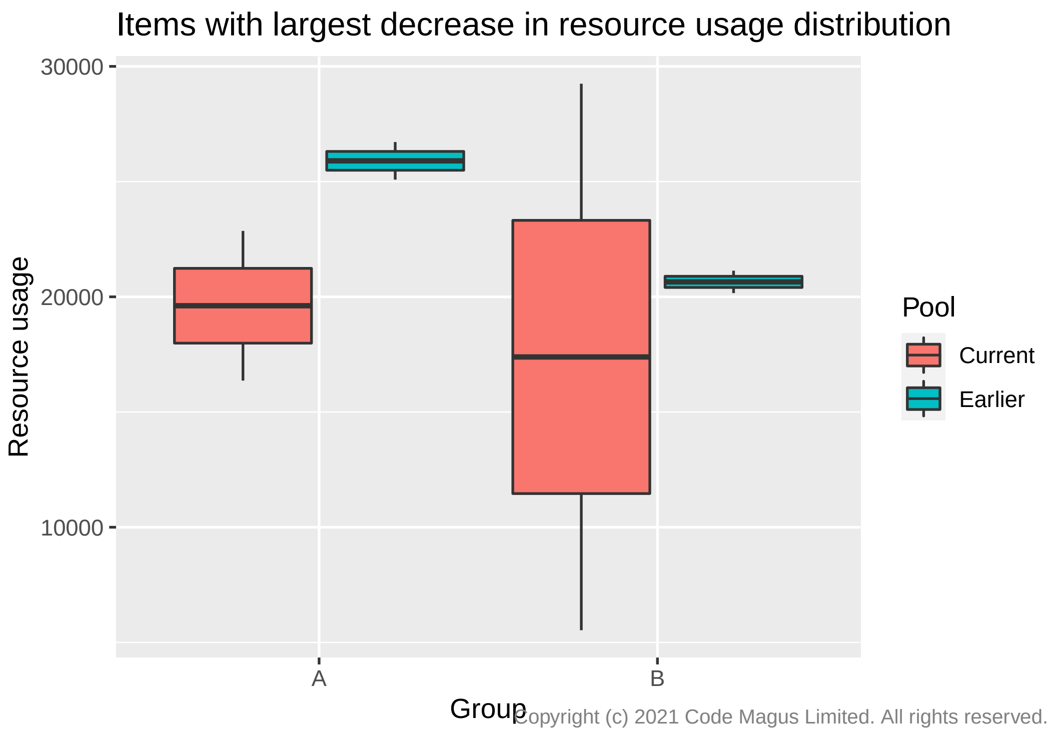


Key	Group
A	LOAD Rate Percent single processor CPU Usage

3.3.1.2 Resource class: Network

The following compares the resource usage decreases from the test started at 2021-05-10 16:52:00 to the tests from previous test sessions.

Class	Coef	Count	Metric	Units	Estimate	Std..Error	PrevCount	PrevEst	PrevSEM	pvalue.1
LOAD	Rate	22	sent	bits per second	19612.35	1623.789	613	25900.80	408.096	0.000
MODEL	Rate	22	recv	bits per second	17389.63	5929.025	612	20648.37	242.773	0.009



Key	Group
A	LOAD Rate bits per second Network Usage sent
B	MODEL Rate bits per second Network Usage recv

4 Comparison of resource usage across tests

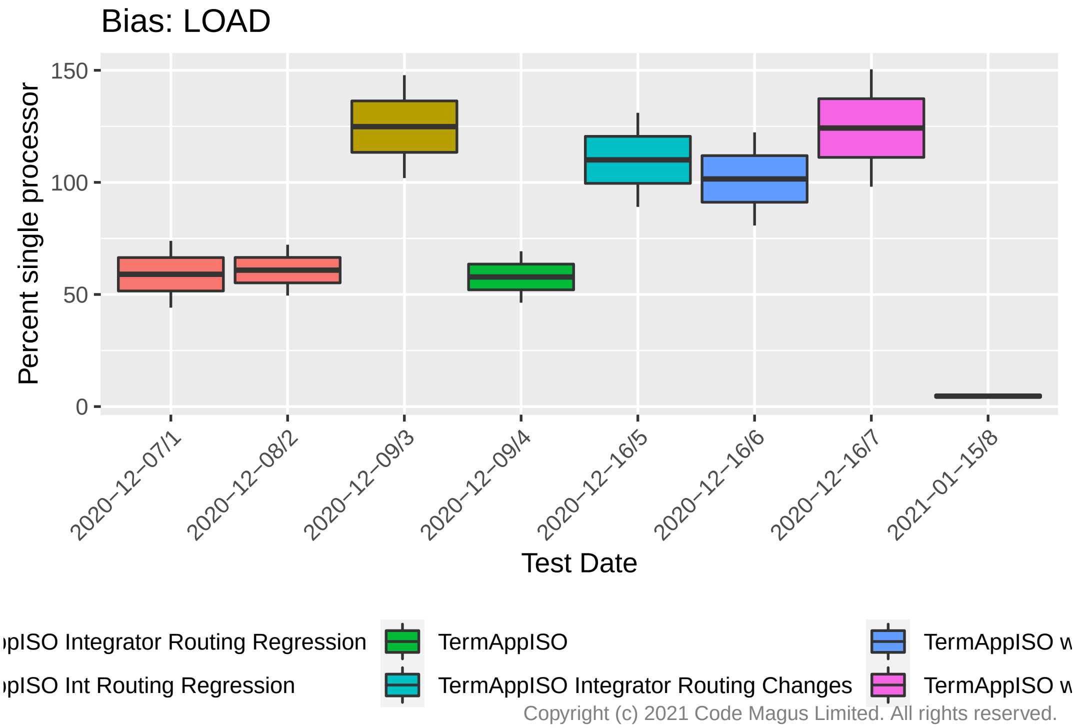
This section compares the resource usage between the NFT tests to date for each of the groups/servers in the classification list for which data has been collected.

In the box-plots that follow, in each case, the centre is the estimated value of the coefficient calculated for the particular test. The lower edge of the box is the corresponding estimated value less the standard error, and the upper edge of the box is the corresponding estimated value plus the standard error. The minimum and maximum values are calculated by taking two times the standard error values in a similar manner.

4.1 CPU Resource usage for LOAD by CPU Usage using cpu.cpu.system.user in Percent single processor

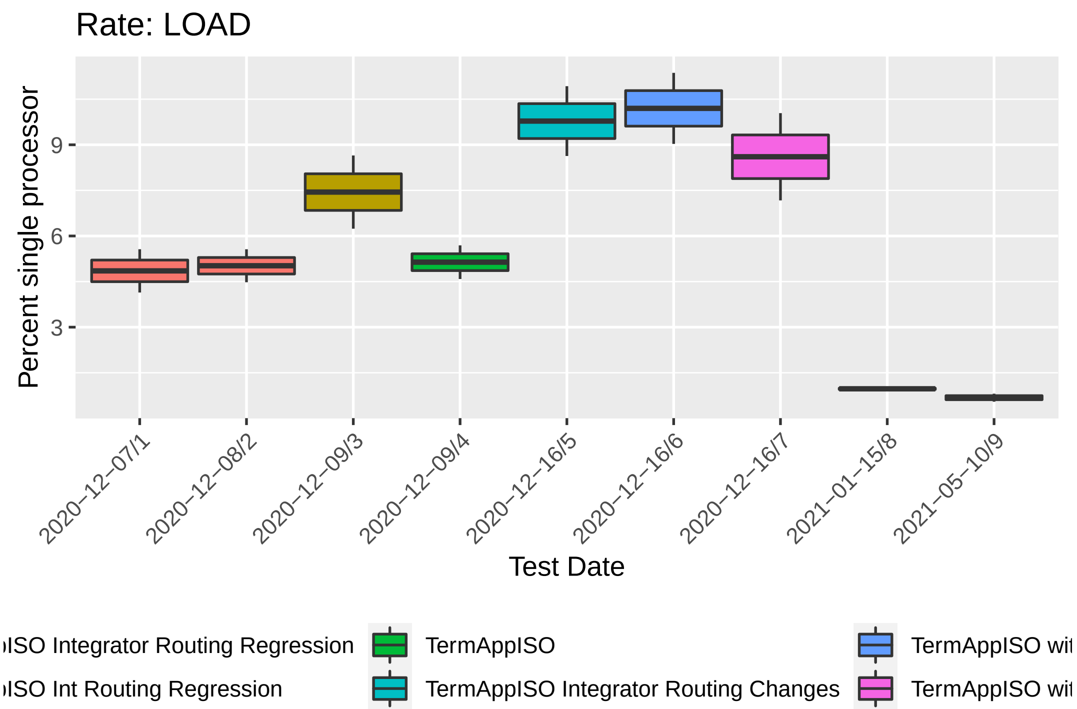
The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: Percent single processor.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Bias	59.012	7.451	7.921	0	TermAppISO Integrator Routing Regression
2020-12-08	Bias	60.847	5.668	10.735	0	TermAppISO Integrator Routing Regression
2020-12-09	Bias	124.874	11.476	10.882	0	TermAppISO Int Routing Regression
2020-12-09	Bias	57.803	5.740	10.071	0	TermAppISO
2020-12-16	Bias	110.050	10.485	10.496	0	TermAppISO Integrator Routing Changes
2020-12-16	Bias	101.540	10.390	9.773	0	TermAppISO with 40 provider threads
2020-12-16	Bias	124.248	13.091	9.491	0	TermAppISO with 80 provider threads
2021-01-15	Bias	4.653	0.462	10.075	0	TermAppISO



The following table shows the Rate coefficient values over the various tests performed. In this table the units of estimate are: Percent single processor.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Rate	4.852	0.356	13.627	0	TermAppISO Integrator Routing Regression
2020-12-08	Rate	5.021	0.271	18.501	0	TermAppISO Integrator Routing Regression
2020-12-09	Rate	7.444	0.602	12.360	0	TermAppISO Int Routing Regression
2020-12-09	Rate	5.138	0.277	18.561	0	TermAppISO
2020-12-16	Rate	9.780	0.574	17.034	0	TermAppISO Integrator Routing Changes
2020-12-16	Rate	10.198	0.584	17.447	0	TermAppISO with 40 provider threads
2020-12-16	Rate	8.606	0.718	11.993	0	TermAppISO with 80 provider threads
2021-01-15	Rate	0.973	0.022	44.250	0	TermAppISO
2021-05-10	Rate	0.680	0.066	10.297	0	TermAppISO

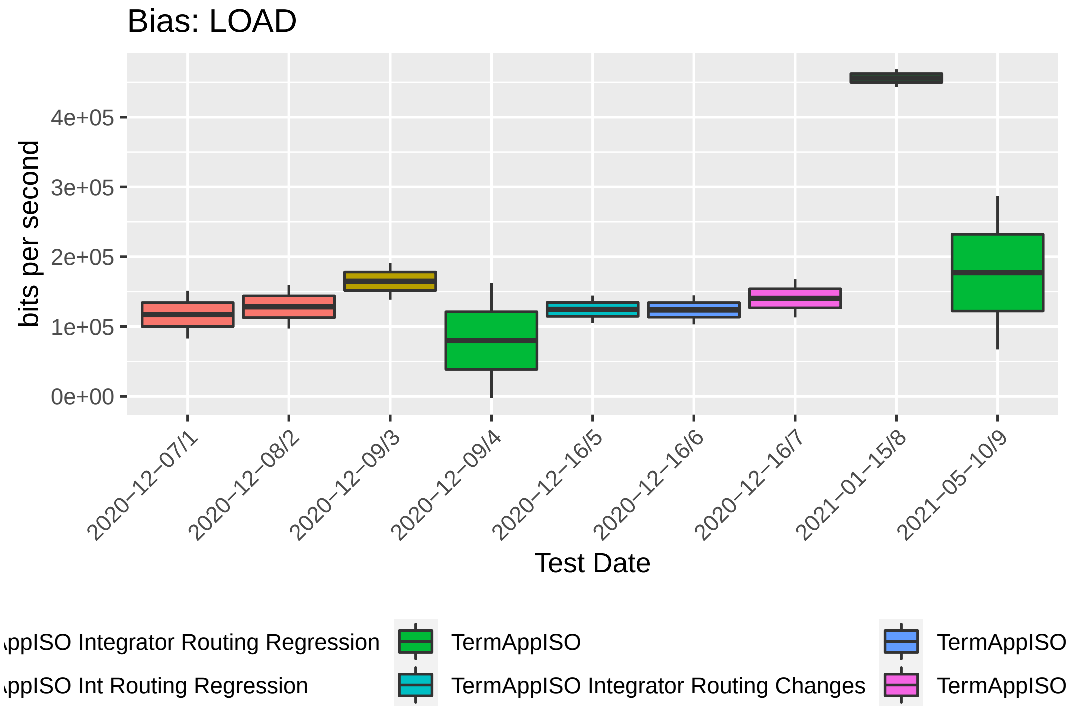


4.2 Network Resource usage for LOAD by Network Usage recv using recv in bits per second

The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Bias	117112.32	17136.631	6.834	0.000	TermAppISO Integrator Routing Regression
2020-12-08	Bias	128316.44	15580.341	8.236	0.000	TermAppISO Integrator Routing Regression
2020-12-09	Bias	164916.40	13191.587	12.502	0.000	TermAppISO Int Routing Regression
2020-12-09	Bias	79903.07	41255.594	1.937	0.056	TermAppISO
2020-12-16	Bias	124584.24	9904.489	12.579	0.000	TermAppISO Integrator Routing Changes
2020-12-16	Bias	123844.15	10400.926	11.907	0.000	TermAppISO with 40 provider threads
2020-12-16	Bias	140398.04	13653.452	10.283	0.000	TermAppISO with 80 provider threads
2021-01-15	Bias	456044.32	6245.241	73.023	0.000	TermAppISO

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2021-05-10	Bias	177202.72	54997.316	3.222	0.004	TermAppISO



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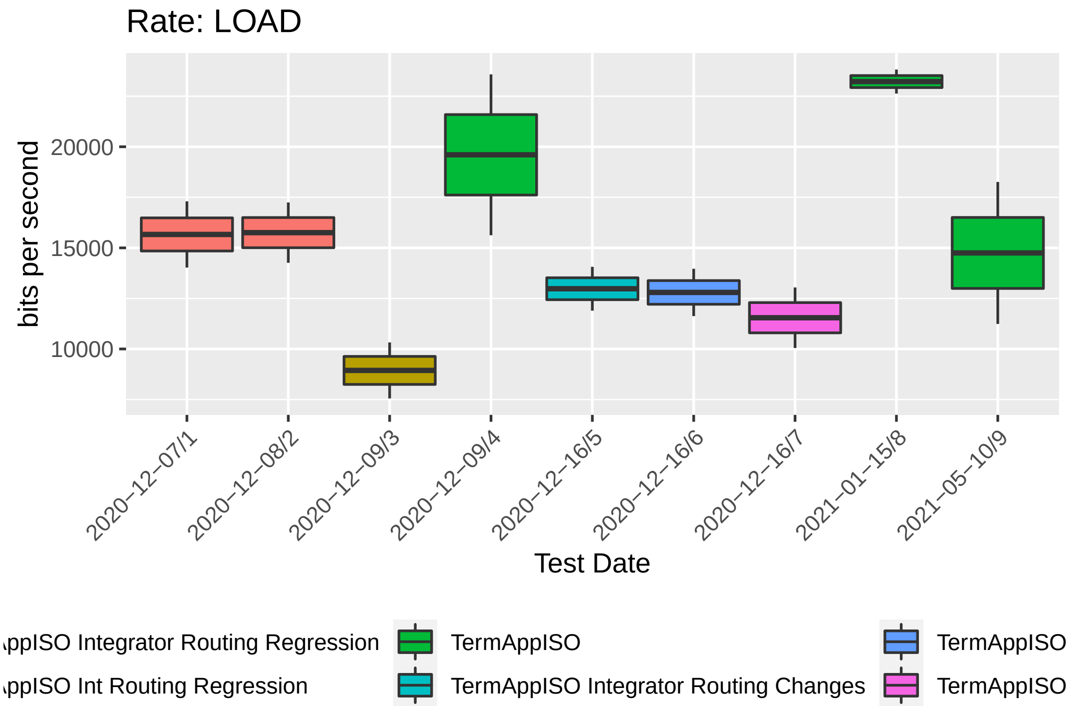
The following table shows the Rate coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Rate	15663.585	818.945	19.127	0	TermAppISO Integrator Routing Regression
2020-12-08	Rate	15753.089	745.948	21.118	0	TermAppISO Integrator Routing Regression
2020-12-09	Rate	8938.586	692.304	12.911	0	TermAppISO Int Routing Regression
2020-12-09	Rate	19602.564	1989.670	9.852	0	TermAppISO
2020-12-16	Rate	12978.364	542.369	23.929	0	TermAppISO Integrator Routing Changes
2020-12-16	Rate	12795.930	585.131	21.868	0	TermAppISO with 40 provider threads
2020-12-16	Rate	11544.987	748.371	15.427	0	TermAppISO with 80 provider threads
2021-01-15	Rate	23224.409	297.261	78.128	0	TermAppISO

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2021-05-10	Rate	14748.670	1755.623	8.401	0	TermAppISO

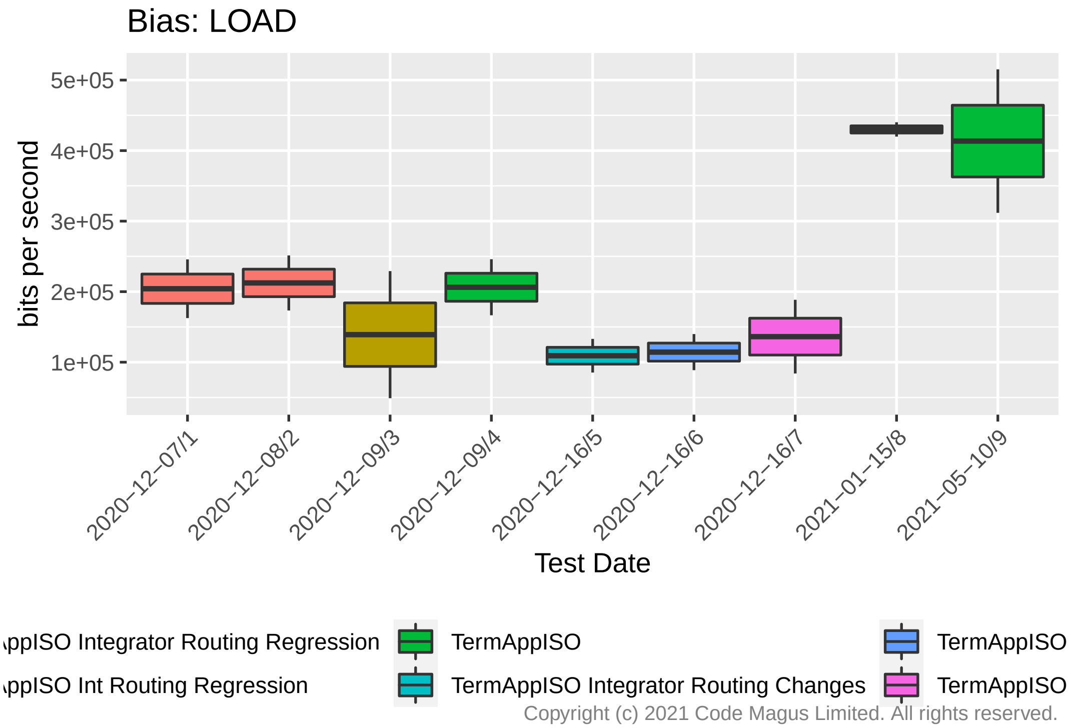


4.3 Network Resource usage for LOAD by Network Usage sent using sent in bits per second

The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Bias	204158.9	20823.67	9.804	0.000	TermAppISO Integrator Routing Regression
2020-12-08	Bias	212375.4	19513.03	10.884	0.000	TermAppISO Integrator Routing Regression
2020-12-09	Bias	139054.3	45057.99	3.086	0.003	TermAppISO Int Routing Regression
2020-12-09	Bias	206257.3	19871.67	10.379	0.000	TermAppISO
2020-12-16	Bias	109170.1	11937.37	9.145	0.000	TermAppISO Integrator Routing Changes

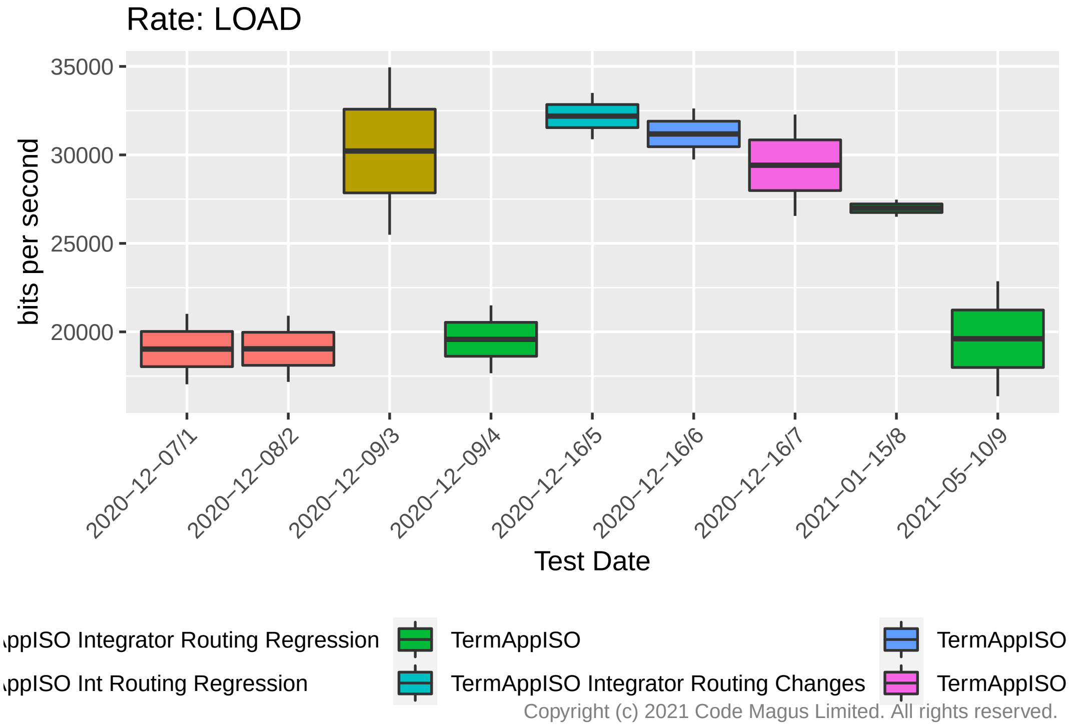
TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-16	Bias	114274.4	12804.75	8.924	0.000	TermAppISO with 40 provider threads
2020-12-16	Bias	136247.9	26123.17	5.216	0.000	TermAppISO with 80 provider threads
2021-01-15	Bias	430030.4	5089.62	84.492	0.000	TermAppISO
2021-05-10	Bias	413513.8	50867.43	8.129	0.000	TermAppISO



The following table shows the Rate coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Rate	19028.66	995.145	19.121	0	TermAppISO Integrator Routing Regression
2020-12-08	Rate	19042.75	934.235	20.383	0	TermAppISO Integrator Routing Regression
2020-12-09	Rate	30219.17	2364.677	12.779	0	TermAppISO Int Routing Regression
2020-12-09	Rate	19579.56	958.369	20.430	0	TermAppISO
2020-12-16	Rate	32193.80	653.690	49.249	0	TermAppISO Integrator Routing Changes

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-16	Rate	31183.83	720.365	43.289	0	TermAppISO with 40 provider threads
2020-12-16	Rate	29416.80	1431.859	20.544	0	TermAppISO with 80 provider threads
2021-01-15	Rate	26987.33	242.256	111.400	0	TermAppISO
2021-05-10	Rate	19612.35	1623.789	12.078	0	TermAppISO

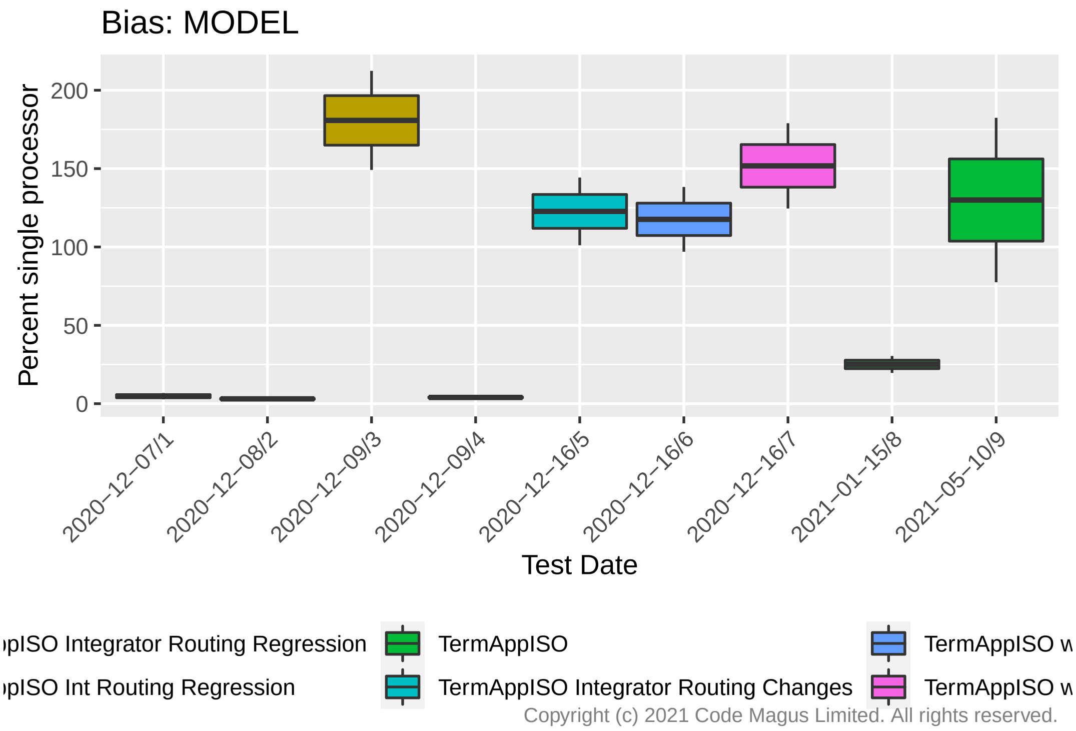


4.4 CPU Resource usage for MODEL by CPU Usage using cpu.cpu.system.user in Percent single processor

The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: Percent single processor.

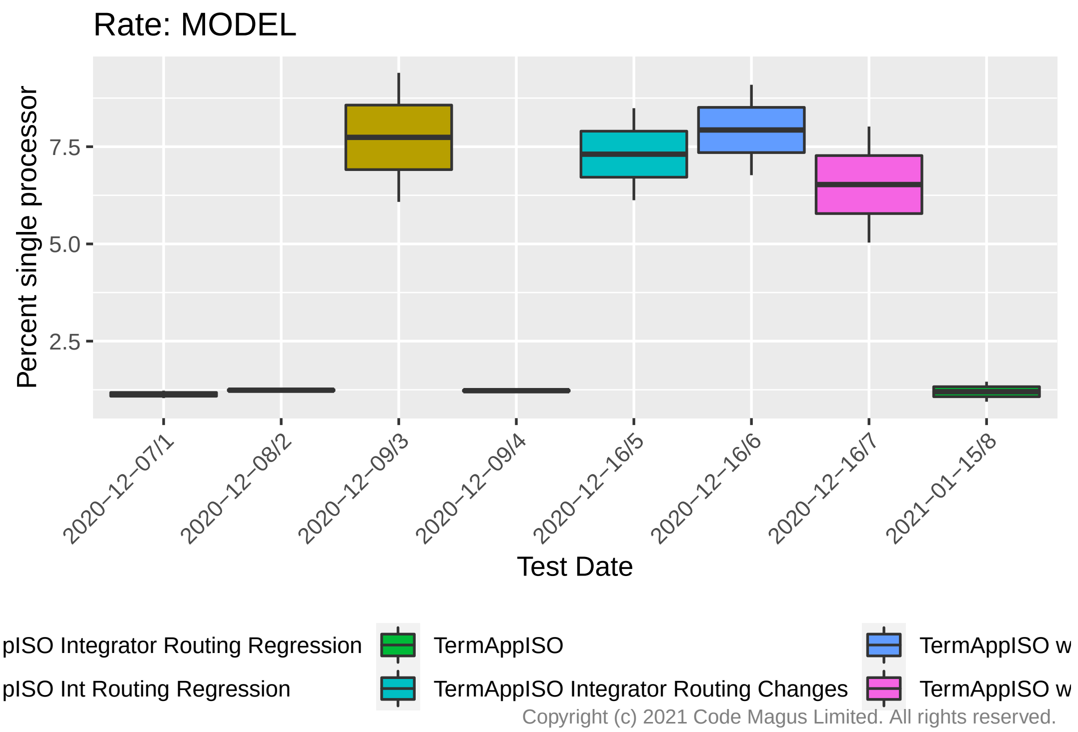
TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Bias	4.808	1.006	4.779	0	TermAppISO Integrator Routing Regression
2020-12-08	Bias	3.084	0.348	8.849	0	TermAppISO Integrator Routing Regression
2020-12-09	Bias	180.757	15.805	11.437	0	TermAppISO Int Routing Regression
2020-12-09	Bias	3.996	0.318	12.580	0	TermAppISO
2020-12-16	Bias	122.689	10.804	11.356	0	TermAppISO Integrator Routing Changes

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-16	Bias	117.633	10.331	11.386	0	TermAppISO with 40 provider threads
2020-12-16	Bias	151.751	13.604	11.155	0	TermAppISO with 80 provider threads
2021-01-15	Bias	25.053	2.701	9.275	0	TermAppISO
2021-05-10	Bias	129.953	26.227	4.955	0	TermAppISO



The following table shows the Rate coefficient values over the various tests performed. In this table the units of estimate are: Percent single processor.

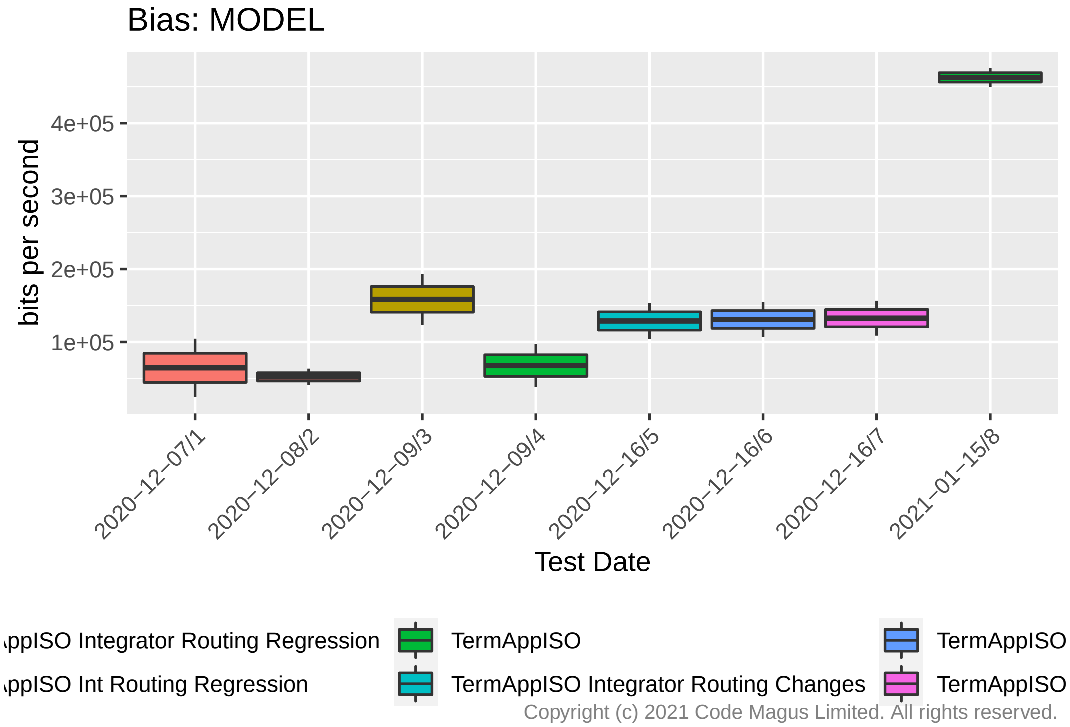
TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Rate	1.132	0.048	23.545	0	TermAppISO Integrator Routing Regression
2020-12-08	Rate	1.239	0.017	74.254	0	TermAppISO Integrator Routing Regression
2020-12-09	Rate	7.740	0.829	9.331	0	TermAppISO Int Routing Regression
2020-12-09	Rate	1.227	0.015	80.090	0	TermAppISO
2020-12-16	Rate	7.307	0.592	12.351	0	TermAppISO Integrator Routing Changes
2020-12-16	Rate	7.929	0.581	13.643	0	TermAppISO with 40 provider threads
2020-12-16	Rate	6.526	0.746	8.752	0	TermAppISO with 80 provider threads
2021-01-15	Rate	1.200	0.129	9.336	0	TermAppISO



4.5 Network Resource usage for MODEL by Network Usage recv using recv in bits per second

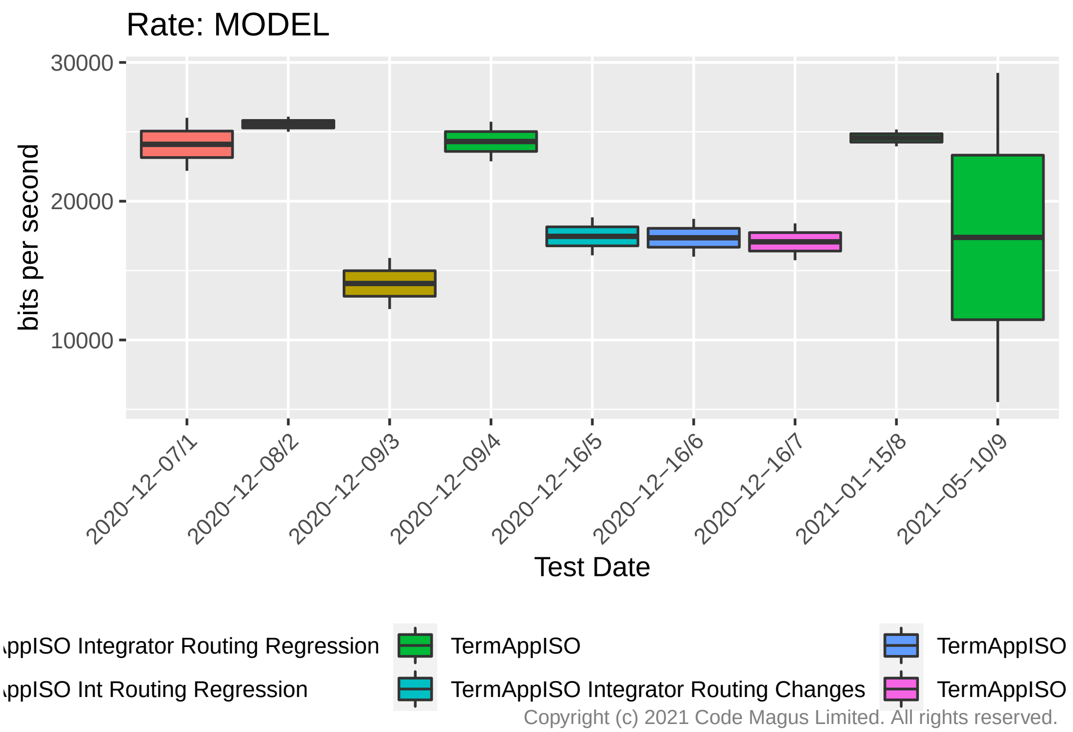
The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Bias	64596.51	19974.205	3.234	0.002	TermAppISO Integrator Routing Regression
2020-12-08	Bias	52159.33	5674.160	9.192	0.000	TermAppISO Integrator Routing Regression
2020-12-09	Bias	158388.92	17536.412	9.032	0.000	TermAppISO Int Routing Regression
2020-12-09	Bias	67665.26	14789.314	4.575	0.000	TermAppISO
2020-12-16	Bias	128789.60	12489.057	10.312	0.000	TermAppISO Integrator Routing Changes
2020-12-16	Bias	130831.54	12093.291	10.819	0.000	TermAppISO with 40 provider threads
2020-12-16	Bias	132636.80	11969.911	11.081	0.000	TermAppISO with 80 provider threads
2021-01-15	Bias	462642.65	6392.297	72.375	0.000	TermAppISO



The following table shows the Rate coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

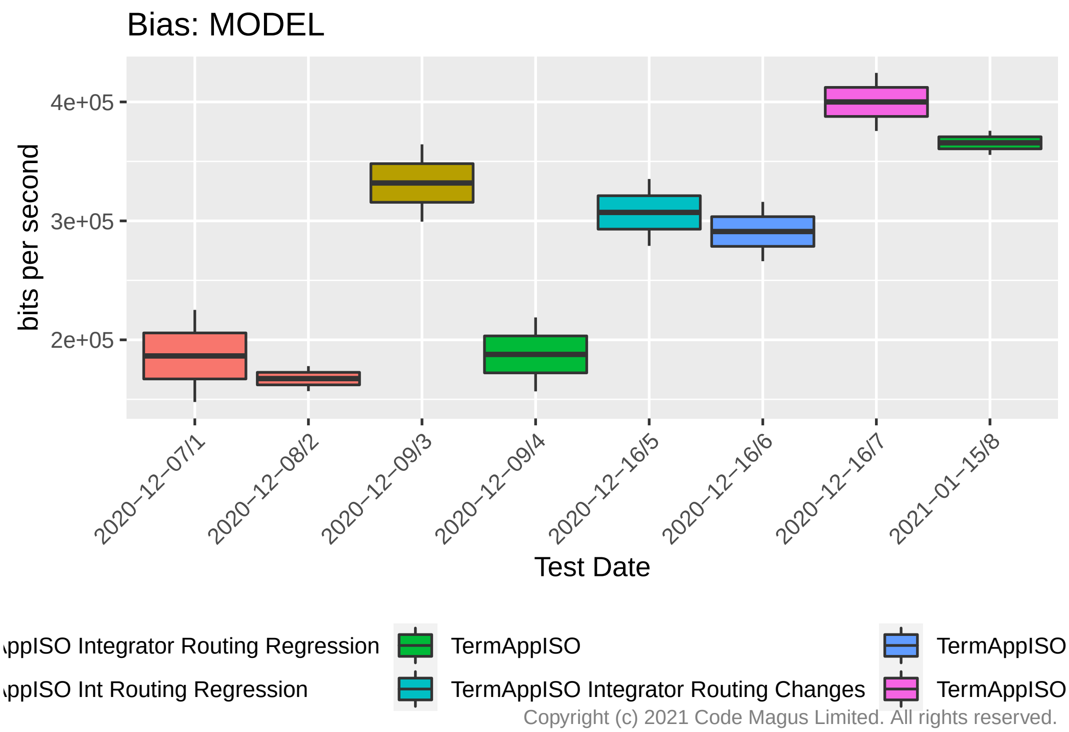
TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Rate	24100.05	954.550	25.248	0.000	TermAppISO Integrator Routing Regression
2020-12-08	Rate	25548.99	271.665	94.046	0.000	TermAppISO Integrator Routing Regression
2020-12-09	Rate	14069.74	920.324	15.288	0.000	TermAppISO Int Routing Regression
2020-12-09	Rate	24302.47	713.257	34.073	0.000	TermAppISO
2020-12-16	Rate	17467.52	683.900	25.541	0.000	TermAppISO Integrator Routing Changes
2020-12-16	Rate	17365.66	680.340	25.525	0.000	TermAppISO with 40 provider threads
2020-12-16	Rate	17074.86	664.909	25.680	0.000	TermAppISO with 80 provider threads
2021-01-15	Rate	24560.17	304.261	80.721	0.000	TermAppISO
2021-05-10	Rate	17389.63	5929.025	2.933	0.008	TermAppISO



4.6 Network Resource usage for MODEL by Network Usage sent using sent in bits per second

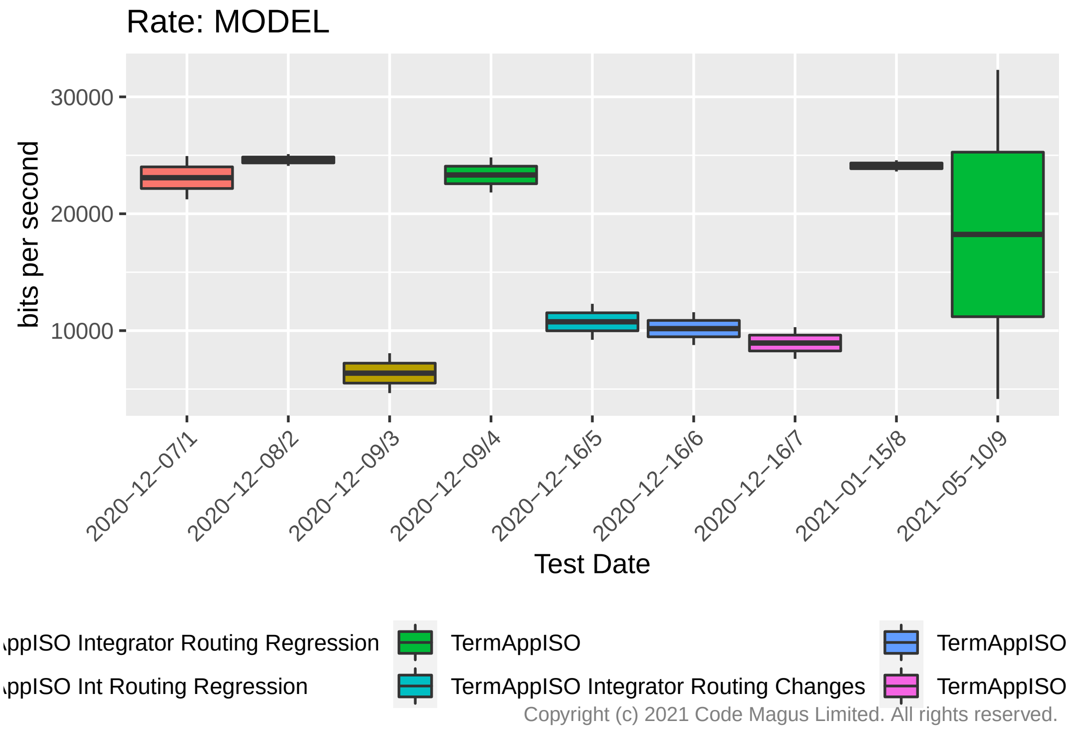
The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Bias	186452.2	19352.666	9.634	0	TermAppISO Integrator Routing Regression
2020-12-08	Bias	167394.2	5260.624	31.820	0	TermAppISO Integrator Routing Regression
2020-12-09	Bias	331861.2	16245.425	20.428	0	TermAppISO Int Routing Regression
2020-12-09	Bias	187742.4	15537.099	12.083	0	TermAppISO
2020-12-16	Bias	307108.4	14052.742	21.854	0	TermAppISO Integrator Routing Changes
2020-12-16	Bias	291049.7	12476.750	23.327	0	TermAppISO with 40 provider threads
2020-12-16	Bias	400012.4	12208.426	32.765	0	TermAppISO with 80 provider threads
2021-01-15	Bias	365642.3	5065.982	72.176	0	TermAppISO



The following table shows the Rate coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

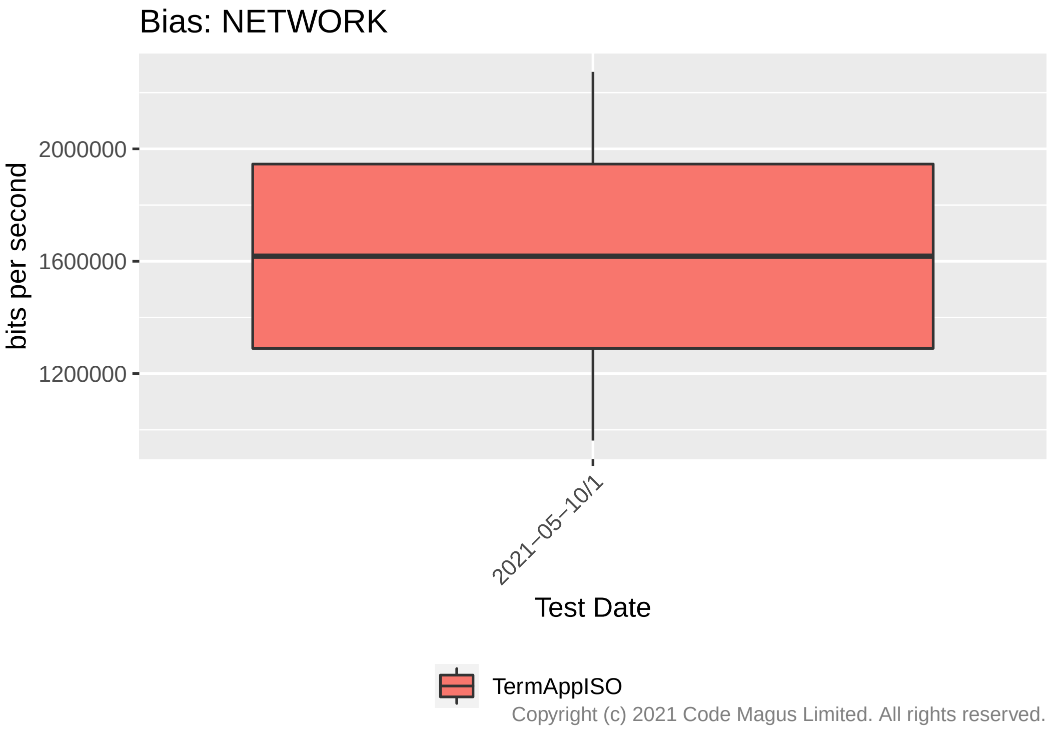
TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2020-12-07	Rate	23083.902	924.847	24.960	0.000	TermAppISO Integrator Routing Regression
2020-12-08	Rate	24600.259	251.866	97.672	0.000	TermAppISO Integrator Routing Regression
2020-12-09	Rate	6362.325	852.572	7.463	0.000	TermAppISO Int Routing Regression
2020-12-09	Rate	23318.892	749.322	31.120	0.000	TermAppISO
2020-12-16	Rate	10756.811	769.527	13.978	0.000	TermAppISO Integrator Routing Changes
2020-12-16	Rate	10172.372	701.912	14.492	0.000	TermAppISO with 40 provider threads
2020-12-16	Rate	8940.326	678.158	13.183	0.000	TermAppISO with 80 provider threads
2021-01-15	Rate	24097.187	241.131	99.934	0.000	TermAppISO
2021-05-10	Rate	18230.092	7038.605	2.590	0.018	TermAppISO



4.7 Network Resource usage for NETWORK by Network Usage recv using recv in bits per second

The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

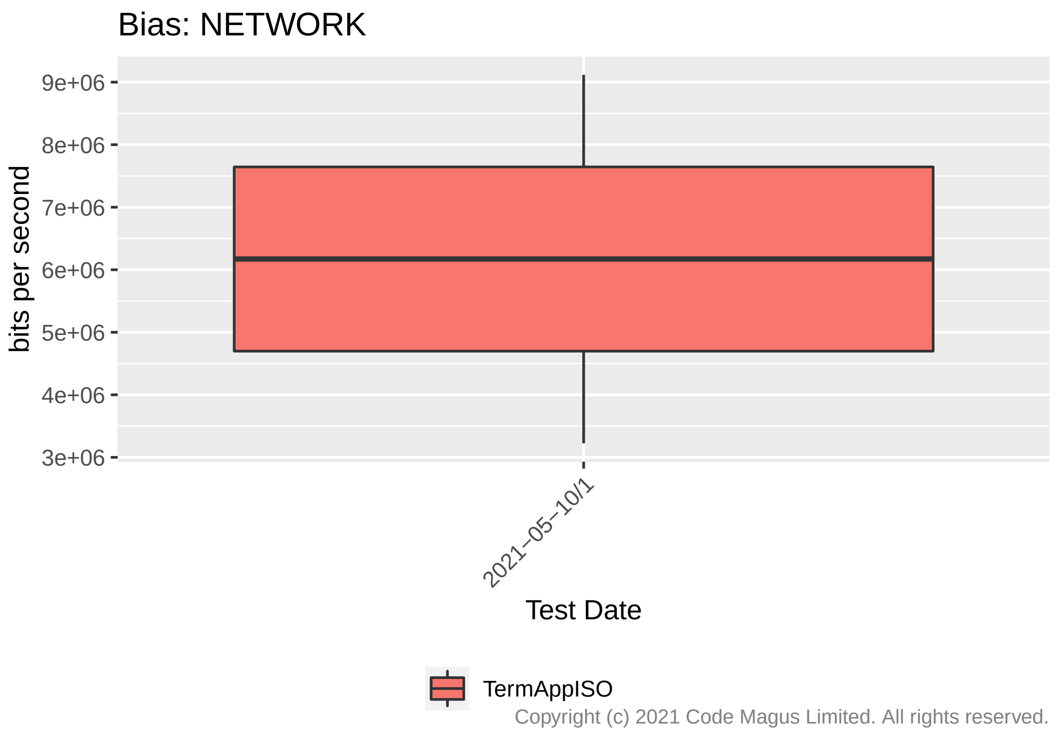
TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2021-05-10	Bias	1617886	328037.6	4.932	0	TermAppISO



4.8 Network Resource usage for NETWORK by Network Usage sent using sent in bits per second

The following table shows the Bias coefficient values over the various tests performed. In this table the units of estimate are: bits per second.

TestDate	Coef	Estimate	Std..Error	t.value	p.value	Test
2021-05-10	Bias	6171231	1472967	4.19	0	TermAppISO



5 Session details

```
sessionInfo();
```

```
## R version 3.6.0 (2019-04-26)
## Platform: x86_64-redhat-linux-gnu (64-bit)
## Running under: CentOS Linux 7 (Core)
##
## Matrix products: default
## BLAS/LAPACK: /usr/lib64/R/lib/libRblas.so
##
## locale:
##  [1] LC_CTYPE=en_US.UTF-8       LC_NUMERIC=C
##  [3] LC_TIME=en_US.UTF-8        LC_COLLATE=en_US.UTF-8
##  [5] LC_MONETARY=en_US.UTF-8    LC_MESSAGES=en_US.UTF-8
##  [7] LC_PAPER=en_US.UTF-8       LC_NAME=C
##  [9] LC_ADDRESS=C               LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] grid      stats     graphics  grDevices utils     datasets  methods
## [8] base
##
```

```
## other attached packages:
## [1] pander_0.6.3    doBy_4.6.7      cmlrutils_1.18  XML_3.98-1.20
## [5] scales_1.1.1    ggplot2_3.3.2   BSDA_1.2.0      lattice_0.20-38
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_1.0.5       highr_0.8        pillar_1.4.6     compiler_3.6.0
##  [5] class_7.3-15     tools_3.6.0      digest_0.6.25    evaluate_0.14
##  [9] lifecycle_0.2.0  tibble_3.0.3     gtable_0.3.0     pkgconfig_2.0.3
## [13] rlang_0.4.7      Matrix_1.2-17    yaml_2.2.1       xfun_0.17
## [17] e1071_1.7-4      withr_2.2.0      stringr_1.4.0    dplyr_1.0.2
## [21] knitr_1.30       generics_0.0.2   vctrs_0.3.2      tidyselect_1.1.0
## [25] glue_1.4.1       R6_2.4.1         rmarkdown_2.6    farver_2.0.3
## [29] tidyr_1.1.2      purrr_0.3.4      cmlbrandr_3.0    magrittr_1.5
## [33] backports_1.1.8  ellipsis_0.3.1   htmltools_0.5.0  MASS_7.3-51.4
## [37] colorspace_1.4-1 Deriv_4.0.1      labeling_0.3     stringi_1.5.3
## [41] munsell_0.5.0    broom_0.7.0      crayon_1.3.4
```