The Serverless Application Analytics Framework: Performance Modeling

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TABLE I. *PERFORMANCE MODEL RESULTS SCNMT2 WORKLOADS*

SCNMT2 Model	Mean Runtime (ms)	STDEV (ms)	Training CV	Test CV	RMSE (ms)	MAE (ms)	MAPE	df
256MB a1 → a2	15833.57	3768.92	0.24	0.238	96.74	78.62	0.51	127
256MB a1 → a3	15837.56	3938.33	0.2479	0.2487	90.94	67.29	0.42	151
256MB a2 → a3	18033.93	4025.3	0.2218	0.2232	71.39	55.17	0.3	127
512MB a1 → a2	7189.17	792.02	0.1167	0.1102	48.68	38.45	0.53	58
512MB a1 → a3	7668.96	1779.75	0.2322	0.2321	99.28	77.89	1.07	414
512MB a2 → a3	8552.5	1041.81	0.1207	0.1218	15.38	9.99	0.11	58
1024MB a1 → a2	3756.67	842.68	0.2426	0.2243	22.78	18.31	0.51	28
1024MB a1 → a3	4051.24	813.88	0.2105	0.2009	81.02	62.24	1.53	406
1024MB a2 → a3	4117	1179.58	0.2858	0.2865	3.88	3.34	0.09	28
2048MB a1 → a2	2432.35	551.93	0.2254	0.2269	10.82	8.87	0.37	155
2048MB a1 → a3	2422	446.54	0.1833	0.1844	12.12	9.31	0.37	265
2048MB a2 → a3	2409.12	501.7	0.2069	0.2083	12.61	9.99	0.41	155
256MB → 512MB a1	10110.96	2020.35	0.2017	0.1998	167.67	131.81	1.3	414
256MB → 1024MB a1	5115.29	1088.94	0.205	0.2129	90.91	70.7	1.43	406
256MB → 2048MB a1	2327.66	514.18	0.2257	0.2209	13.99	11.48	0.5	265
256MB → 512MB a2	8940.83	1079.02	0.1234	0.1207	27.83	20.51	0.21	58
256MB → 1024MB a2	4842	682.47	0.1418	0.1409	15.61	14.17	0.29	28
256MB → 2048MB a2	2389.93	548.66	0.2309	0.2296	12.61	9.68	0.39	127
256MB → 512MB a3	7681.75	1628.22	0.2184	0.212	38.33	25.62	0.33	151
256MB → 1024MB a3	3746.88	920.34	0.2487	0.2456	14.29	11.84	0.34	151
256MB → 2048MB a3	2344.06	563.16	0.2472	0.2402	14.38	8.68	0.33	151

TABLE II. *PERFORMANCE MODEL RESULTS SCMT2 WORKLOADS*

SCMT2 Model	Mean Runtime (ms)	STDEV (ms)	Training CV	Test CV	RMSE (ms)	MAE (ms)	MAPE	df
256MB a1 → a2	45382.43	10384.19	0.2242	0.2288	206.29	139.2	0.28	127
256MB a1 → a3	47245.12	11071.88	0.2298	0.2343	227.68	149.02	0.29	151
256MB a2 → a3	52646.21	12233.77	0.2309	0.2324	202.5	154.28	0.3	127
512MB a1 → a2	20433.5	6351.5	0.3055	0.3108	103.98	74.95	0.38	58
512MB a1 → a3	25927.89	5230.08	0.2847	0.2017	2416.4	1865.71	6.98	414
512MB a2 → a3	21201.5	3450.42	0.17	0.1627	57.75	54.18	0.26	58
1024MB a1 → a2	11235.33	3290.99	0.2958	0.2929	26	21.47	0.23	28
1024MB a1 → a3	11860.51	2642.17	0.2665	0.2228	1224.3	968.58	7.83	406
1024MB a2 → a3	11447.33	3093.38	0.2731	0.2702	77.95	72.98	0.61	28
2048MB a1 → a2	6756.94	1305.3	0.1993	0.1932	95.69	70.14	1.03	157
2048MB a1 → a3	6982.93	1441.66	0.2691	0.2065	641.39	503.28	6.95	266
2048MB a2 → a3	7445	1712.71	0.2138	0.23	361.19	265.22	3.33	157
256MB → 512MB a1	42047.54	10166.27	0.2437	0.2418	3691.45	3336.12	8.15	414
256MB → 1024MB a1	20077.02	5005.32	0.2163	0.2493	1499.13	1114.89	5.52	406
256MB → 2048MB a1	7719.97	1796.84	0.1811	0.2328	826.25	658.51	8.28	266
256MB → 512MB a2	21162.5	5850.52	0.274	0.2765	82.91	63.71	0.28	58
256MB → 1024MB a2	11167.33	879.6	0.0797	0.0788	51.02	35.88	0.3	28
256MB → 2048MB a2	6528.36	1185.74	0.19	0.1816	125.79	89.54	1.32	127
256MB → 512MB a3	23795.12	5203.18	0.2214	0.2187	164.3	124.04	0.47	151
256MB → 1024MB a3	11584.31	2590.41	0.2253	0.2236	135.75	112.13	1	151
256MB → 2048MB a3	6531.5	1601.19	0.2276	0.2451	300.37	216.48	2.98	151

TABLE III.   *PERFORMANCE MODEL RESULTS SCSMT2 WORKLOADS*

SCSMT2 Model	Mean Runtime (ms)	STDEV (ms)	Training CV	Test CV	RMSE (ms)	MAE (ms)	MAPE	df
256MB a1 → a2	42759.24	12110.69	0.3004	0.2832	1218.04	1005.45	2.96	1414
256MB a1 → a3	45520.71	14542.2	0.3335	0.3195	1024MB .36	807.56	2.36	1613
256MB a2 → a3	48747.47	13743.09	0.2736	0.2819	774.98	605.46	1.59	1414
512MB a1 → a2	19662.67	5470.98	0.3086	0.2782	695.99	550.55	3.13	652
512MB a1 → a3	21686.42	6899.5	0.4	0.3181	2816.69	2375.5	11.52	4572
512MB a2 → a3	20933.28	6800.99	0.3164	0.3249	355.31	293.07	1.53	652
1024MB a1 → a2	9240.53	2650.33	0.3529	0.2868	462.33	316.33	3.7	325
1024MB a1 → a3	10122	3399.21	0.4252	0.3358	1217.9	998.88	10.54	4478
1024MB a2 → a3	10202.69	3612.71	0.3421	0.3541	266.27	214.37	2.25	325
2048MB a1 → a2	4603.39	1666.14	0.4171	0.3619	223.25	168.85	4.14	1739
2048MB a1 → a3	5299.21	1915.1	0.4361	0.3614	707.18	566.92	11.86	2938
2048MB a2 → a3	5114.97	1763.12	0.3188	0.3447	376.45	284.65	5.91	1739
256MB → 512MB a1	36500.36	14527.64	0.3622	0.398	4988.16	3771.51	10.58	4572
256MB → 1024MB a1	15135.99	6353.93	0.3429	0.4198	2555.22	1757.67	16.31	4478
256MB → 2048MB a1	5527.18	2443.87	0.3141	0.4422	1250.25	927.67	19.82	2938
256MB → 512MB a2	19789.62	5966.73	0.2928	0.3015	363.15	272.99	1.62	652
256MB → 1024MB a2	9806.22	3354.23	0.3172	0.3421	534.8	441.12	6.04	325
256MB → 2048MB a2	4654.28	1538.04	0.2832	0.3305	570.48	485.56	11.31	1414
256MB → 512MB a3	20654.36	6668.28	0.3157	0.3229	645.61	515.38	3.02	1613
256MB → 1024MB a3	9505.2	3255.82	0.3157	0.3425	743.93	572.47	7.43	1613
256MB → 2048MB a3	4865.45	1853.49	0.3157	0.3809	770.51	590.92	14.15	1613

TABLE IV.   *PERFORMANCE MODEL RESULTS SCNMT2 AWS→IBM*

SCNMT2 IBM Model	Mean Runtime (ms)	STDEV (ms)	Training CV	Test CV	RMSE (ms)	MAE (ms)	MAPE	df
256MB a1 → i3	28887.68	4278.86	0.1511	0.1481	1074.34	880.92	3.14	171
256MB a1 → i4	26141.55	6081.51	0.2159	0.2326	1695.29	1297.76	4.79	200
512MB a1 → i1	17206.62	2922.44	0.1638	0.1698	762.88	602.94	3.51	142
512MB a1 → i2	15023.95	2813.67	0.1966	0.1873	1217.56	884.35	5.95	369
512MB a1 → i3	13412.55	2239.53	0.1409	0.167	620.17	388.37	2.75	99
512MB a1 → i4	12466.22	920.66	0.0911	0.0739	759.72	575.13	4.47	85
1024MB a1 → i1	8320.35	1668.79	0.2002	0.2006	371.95	288.18	3.68	236
1024MB a1 → i2	7427.39	1729.31	0.2201	0.2328	434.56	292.84	3.98	395
1024MB a1 → i3	7326	443.16	0.0684	0.0605	173.89	164.48	2.21	49
1024MB a1 → i4	6700	1067.37	0.1622	0.1593	448.36	274.36	3.91	70
2048MB a1 → i1	4038.53	1163.06	0.2616	0.288	164.59	110.56	3.44	139
2048MB a1 → i2	3566.34	787.34	0.1994	0.2208	185.11	131.21	3.67	265
2048MB a1 → i3	2855.5	661.97	0.2061	0.2318	34.7	30.67	1.17	42
2048MB a1 → i4	2403	347.9	0.1673	0.1448	74.87	59.14	2.29	24

Legend:
Mean Runtime – Average runtime for workload in ms
STDEV – Standard deviation of workload in ms
Training CV – Coefficient of Variation for training dataset
Test CV – Coefficient of Variation for test dataset
RMSE – Root Mean Squared Error in ms
MAE – Mean Absolute Error in ms
MAPE – Mean Absolute Percent Error
df – Degrees of Freedom