# Predicting Performance and Cost of Serverless Computing Functions with SAAF


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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 | 1024.36 | 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

| Platform | Intel Xeon CPU | VM | Alias |
|---|---|---|---|
| AWS | E5-2680v2 @ 2.8 GHz, 10 core | c3 | **a1** |
| AWS | E5-2676v3 @ 2.4 GHz, 12 core | m4 | **a2** |
| AWS | E5-2686v4 @ 2.3 GHz, 18 core | r4 | **a3** |
| IBM | E5-2683v3 @ 2.0 GHz, 14 core | unseen | **i1** |
| IBM | E5-2683v4 @ 2.1 GHz, 16 core | bl2/b1/m1 | **i2** |
| IBM | E5-2650v4 @ 2.2 GHz, 12 core | u1 | **i3** |
| IBM | E5-2690v4 @ 2.6 GHz, 14 core | c1 | **i4** |
| IBM | Gold 6140 @ 2.3 GHz, 18 core | unseen | **i5** |