

An Analysis of Computational Efficiency in Azure App Service

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Introduction

This paper examines Microsoft Azure App Service, focusing on service tiers, thread counts, and computing efficiency. It explores the performance of single- and multi-threaded workloads, particularly in Fibonacci calculations, across different tiers. Results show that lower cost tiers often outperform premium ones in cost efficiency and computing, albeit with some inconsistencies. The study also addresses the inherent unknowns in Platform as a Service (PaaS), offering insights for Developers, DevOps, and Software Architects. Utilising heat maps and line charts, the research analyses the calculation time for Fibonacci numbers on servers across East US, West Europe, and Southeast Asia. It investigates the correlation between server-tier performance, costs, and regional architectural differences. The findings, presented through graphs and critical observations, underscore the importance of tier selection based on workload and location, concluding with recommendations for cloud service optimisation.

Azure Analysis

This study investigates Azure App Service's handling of single-threaded applications. Two key questions guide the research: **1)** How does Azure handle concurrent HTTP requests in single-threaded architecture regarding core utilization? and **2)** Are there performance differences in Azure deployments across regions? The research uses a Fibonacci calculation API to explore core utilisation and performance across service tiers and regions and cost-effectiveness in cloud applications.

Knowledge Gaps

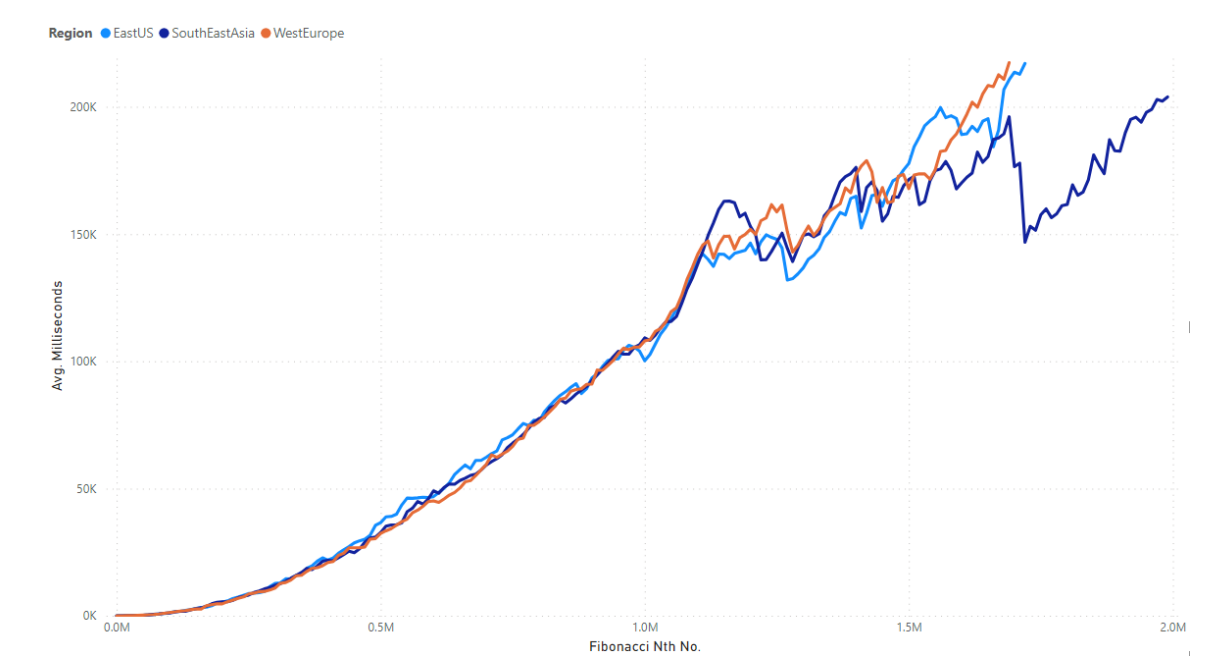
Despite extensive Azure App Service learning resources, gaps remain in understanding the PaaS model's resource utilization. This thesis focuses on four key areas: **Tier Performance, Real-World Application Scenarios, Impact of Regional Variations, and a Detailed Cost-Benefit Analysis.** It examines explicitly the performance and cost of single-threaded versus multi-threaded workloads in Azure, addressing crucial knowledge gaps in cloud computing literature.

Thesis Structure

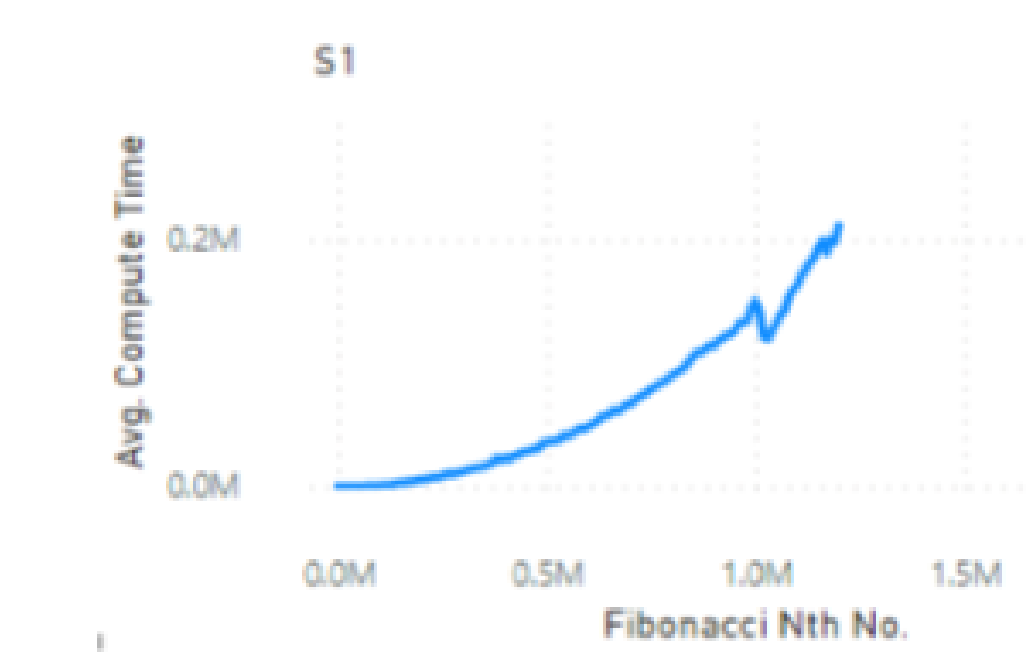
Methodology:

This research examines Azure App Service's performance using a FibonacciCalculationAPI. Tests were conducted across three regions (West Europe, East US, Southeast Asia) on nine Azure tiers, focusing on CPU and memory usage. The API, developed in ASP.NET Core, was monitored using Azure Application Insights. Custom C tests simulated different thread loads, with results analyzed in Power BI to understand efficiency and scalability in cloud environments and regional variation impacts.

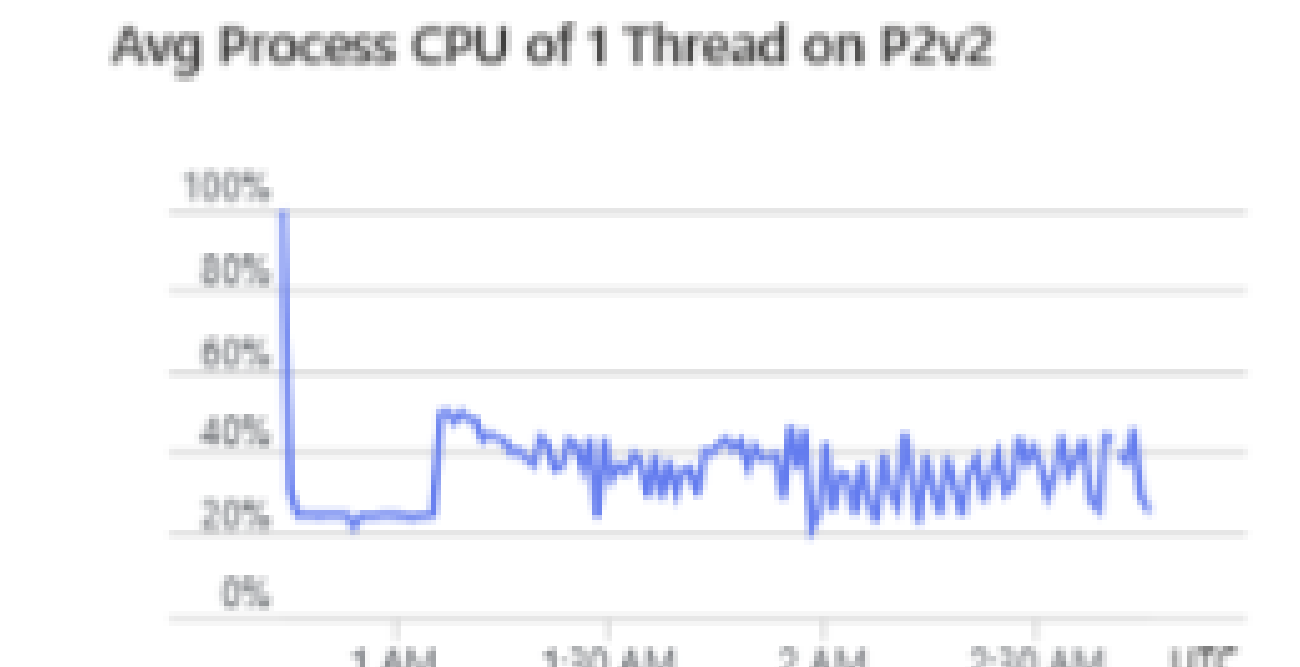
Regional Compute Times:



Tier Compute Times:



Core Utilisation Analysis:



Summary:

Power BI analysis of Azure App Service tests revealed: **1)** Higher performance in premium tiers, suggesting a price-performance correlation. **2)** Single-threaded tasks are uniformly handled, while multi-threaded tasks show concurrency complexities. **3)** The premium tier demonstrates efficient CPU utilization across varying loads. **4)** Cost efficiency is crucial in computational power allocation. These insights guide IT professionals in understanding Azure's hardware management, aiding in informed service tier selection for applications.

Topic Overview

This matrix visualisation analyses thread count impact on Azure App Service performance, using Fibonacci computations as a metric. It shows average compute times across single, two, and four-threaded tests, visualised through a heat map indicating time from white (minimum) to red (maximum). Key insights include uniformity in single-threaded performance, variable multi-threaded behaviour, and the effect of thread failure on overall efficiency. The study highlights the nuances in resource allocation and thread management within Azure.

Fibonacci Nth No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1010000	119.8705	106.6615	97.7142	94.2077	88.7025	80.9329	86.4562	44.4844	106.8881	106.3172	76.1571	109.5551	116.1931	42.3150	102.2345	101.0973	46.2084	108.9922	122.3474	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1020000	123.6028	113.9926	104.6127	117.2720	101.1687	95.7463	87.4453	47.6870	126.0971	126.0924	86.8642	119.2774	124.4753	46.2476	108.6751	105.1212	46.2476	108.6751	120.7773	139.2034	86.9739	108.6751	117.0970	121.4354	127.6247	47.5759	102.8247
1030000	132.8474	119.9824	109.9412	116.4748	104.5175	98.0024	90.3891	49.8024	131.0773	131.0736	88.2009	131.2444	124.4445	45.8811	119.2746	116.4884	46.2084	108.6751	123.3448	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1040000	144.0641	127.7482	122.9182	115.5474	109.1881	99.7729	92.6830	52.0089	139.8793	144.8242	91.5833	138.4884	134.8929	47.8740	119.7480	118.7193	47.8740	119.7480	127.3384	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1050000	156.9971	131.7655	124.9476	116.7456	110.1905	101.4034	94.4048	54.4944	150.2366	150.2378	95.4919	152.8732	152.2757	47.2485	122.9070	121.8804	47.2485	122.9070	132.5004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1060000	171.4824	139.4924	131.4824	119.1716	112.5931	103.4841	96.1545	57.8925	162.8641	162.8641	99.0141	166.0924	161.2273	48.0977	125.3531	124.3028	48.0977	125.3531	137.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1070000	187.8871	148.4448	139.8776	125.8776	118.1444	108.2444	100.3874	61.2977	176.2444	176.2444	103.8444	178.2444	172.4444	48.8444	128.4444	127.4444	48.8444	128.4444	140.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1080000	205.8824	158.4444	149.8776	134.8776	121.1444	111.2444	103.3874	64.6874	191.8444	191.8444	106.8444	182.8444	176.4444	49.6444	131.4444	130.4444	49.6444	131.4444	142.2004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1090000	225.4824	169.4444	160.8776	141.8776	126.1444	113.2444	105.3874	68.6874	207.8444	207.8444	111.8444	198.8444	192.4444	50.4444	134.4444	133.4444	50.4444	134.4444	144.6004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1100000	246.4824	181.4444	172.8776	153.8776	131.1444	116.2444	107.3874	73.6874	225.8444	225.8444	116.8444	210.8444	204.4444	51.2444	137.4444	136.4444	51.2444	137.4444	147.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1110000	268.4824	194.4444	184.8776	166.8776	136.1444	119.2444	109.3874	79.6874	245.8444	245.8444	121.8444	220.8444	214.4444	52.0444	140.4444	139.4444	52.0444	140.4444	149.4004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1120000	291.4824	208.4444	206.8776	181.8776	146.1444	122.2444	111.3874	84.6874	267.8444	267.8444	126.8444	230.8444	224.4444	52.8444	143.4444	142.4444	52.8444	143.4444	150.8004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1130000	315.4824	223.4444	228.8776	198.8776	156.1444	125.2444	113.3874	90.6874	291.8444	291.8444	131.8444	244.8444	238.4444	53.6444	146.4444	145.4444	53.6444	146.4444	154.2004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1140000	340.4824	239.4444	254.8776	218.8776	166.1444	128.2444	115.3874	96.6874	317.8444	317.8444	136.8444	258.8444	252.4444	54.4444	149.4444	148.4444	54.4444	149.4444	158.6004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1150000	366.4824	256.4444	281.8776	240.8776	176.1444	132.2444	117.3874	102.6874	345.8444	345.8444	141.8444	274.8444	268.4444	55.2444	152.4444	151.4444	55.2444	152.4444	163.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1160000	393.4824	274.4444	309.8776	264.8776	186.1444	137.2444	119.3874	108.6874	375.8444	375.8444	146.8444	290.8444	284.4444	56.0444	155.4444	154.4444	56.0444	155.4444	166.4004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1170000	421.4824	293.4444	338.8776	290.8776	196.1444	142.2444	121.3874	114.6874	406.8444	406.8444	151.8444	304.8444	298.4444	56.8444	158.4444	157.4444	56.8444	158.4444	170.2004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1180000	450.4824	313.4444	368.8776	318.8776	216.1444	147.2444	123.3874	116.6874	439.8444	439.8444	156.8444	319.8444	313.4444	57.6444	161.4444	160.4444	57.6444	161.4444	174.6004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1190000	480.4824	334.4444	409.8776	349.8776	236.1444	152.2444	125.3874	118.6874	474.8444	474.8444	161.8444	334.8444	328.4444	58.4444	164.4444	163.4444	58.4444	164.4444	179.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1200000	511.4824	356.4444	451.8776	381.8776	256.1444	157.2444	127.3874	120.6874	511.8444	511.8444	166.8444	350.8444	344.4444	59.2444	167.4444	166.4444	59.2444	167.4444	183.8004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1210000	543.4824	379.4444	494.8776	414.8776	276.1444	162.2444	129.3874	122.6874	547.8444	547.8444	171.8444	366.8444	360.4444	60.0444	170.4444	169.4444	60.0444	170.4444	189.2004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1220000	576.4824	403.4444	539.8776	448.8776	296.1444	167.2444	131.3874	124.6874	584.8444	584.8444	176.8444	383.8444	377.4444	60.8444	173.4444	172.4444	60.8444	173.4444	193.6004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1230000	610.4824	428.4444	595.8776	493.8776	316.1444	172.2444	133.3874	126.6874	623.8444	623.8444	181.8444	401.8444	395.4444	61.6444	176.4444	175.4444	61.6444	176.4444	203.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1240000	645.4824	454.4444	653.8776	543.8776	336.1444	177.2444	135.3874	128.6874	664.8444	664.8444	186.8444	418.8444	412.4444	62.4444	179.4444	178.4444	62.4444	179.4444	215.4004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1250000	681.4824	481.4444	714.8776	593.8776	356.1444	182.2444	137.3874	130.6874	707.8444	707.8444	191.8444	436.8444	430.4444	63.2444	182.4444	181.4444	63.2444	182.4444	227.8004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1260000	718.4824	509.4444	776.8776	643.8776	376.1444	187.2444	139.3874	132.6874	752.8444	752.8444	196.8444	455.8444	449.4444	64.0444	185.4444	184.4444	64.0444	185.4444	240.2004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1270000	756.4824	538.4444	840.8776	703.8776	396.1444	192.2444	141.3874	134.6874	800.8444	800.8444	201.8444	475.8444	469.4444	64.8444	188.4444	187.4444	64.8444	188.4444	252.6004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1280000	795.4824	568.4444	906.8776	763.8776	416.1444	197.2444	143.3874	136.6874	846.8444	846.8444	206.8444	495.8444	489.4444	65.6444	191.4444	190.4444	65.6444	191.4444	265.0004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1290000	835.4824	599.4444	974.8776	823.8776	436.1444	202.2444	145.3874	138.6874	894.8444	894.8444	211.8444	516.8444	510.4444	66.4444	194.4444	193.4444	66.4444	194.4444	277.4004	142.8034	86.9552	102.2476	111.3393	115.0047	118.5844	46.8763	102.8247
1300000	876.4824	631.4444	1044.8776	8																							