

A Survey Paper on Cloud Computing

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ABSTRACT

In the next 10 years in cloud computing won't be like the last 10. Cloud has firmly planted its footprint on the other side of the chasm with the momentum of the entire multitrillion-dollar technology business behind it. Both sellers and buyers are leaning in by adopting cloud technologies and many are building their own value layers on top of cloud. In the coming years we expect innovation will continue to coalesce around the big three U.S. clouds, plus Alibaba in Asia-Pacific, with the ecosystem building value on top of the hardware, software and tools provided by the hyperscalers. Importantly, we don't see this as a race to the bottom. Rather, our expectation is that the large public cloud players will continue to take cost out of their platforms through innovation, automation and integration. Other cloud providers and the ecosystem, including traditional information technology buyers, will leverage hyperscale clouds and mine opportunities in their respective markets. This is not a zero-sum game. In this paper we'll update our latest projections in the cloud market, share some new Enterprise Technology Research survey data with some surprising nuggets; and drill into the important cloud database landscape.

Keywords: Cloud computing, hyperscale clouds, cloud database

1. INTRODUCTION

Let's take a look at what people are talking about in cloud and some of the recent news.

1.1 Google Cloud

With the exception of Alibaba Group Holding Ltd., all the large cloud players have reported earnings. Google Cloud continues to focus on growth at the expense of profitability. Google LLC parent Alphabet Inc. reported that its cloud business, which includes applications such as Google Workspace, grew 45% to \$5.5 billion, but it had an operating loss of \$890 million. Since Thomas Kurian joined Google to run the cloud business, Google has increased headcount in its cloud business from 25,000 to 40,000 in an effort to catch up. But playing catch-up is expensive. To put this in perspective, Amazon Web Services Inc.'s revenue in the first quarter of 2018 was \$5.4 billion, almost exactly the same size as Google's current total cloud business. And AWS was growing faster back then at 49%. Remember, Google includes in its cloud numbers a big chunk of high-margin software. AWS had an operating profit of \$1.4 billion that quarter, about 26% of its revenue. So it was a highly profitable business – about as profitable as Cisco's overall business, which is a great business. This is what happens when you're No. 3 and didn't get your head out of your ads fast enough. Now in fairness, Google still gets high marks on the quality of its technology. According to Corey Quinn of the Duckbill Group, Amazon and Google Cloud are "neck and neck with regard to reliability," with Microsoft Corp.'s Azure trailing because of significant disruptions in the past. These comments were made last week in a Bloomberg article despite some recent high-profile outages on AWS. Not surprisingly, a Microsoft spokesperson says that the company's cloud offers "industry-leading reliability" and that it gives customers payment credits after some outages.

1.2 Microsoft Azure

Microsoft's overall cloud business surpassed \$22 billion in the December quarter, up 32% year on year. Like Google, Microsoft includes application software and software-as-a-service offerings in its cloud numbers and it gives nuggets of guidance on its Azure infrastructure-as-a-service business. We estimate that Azure comprises about 45% of Microsoft's overall cloud business, which we think hit a \$40 billion run rate last quarter. Microsoft guided in its earnings call that recent declines in Azure growth rates will reverse in Q1 and show sequential growth. Finally, it was announced that the Federal Trade Commission, not the Department of Justice, will review Microsoft's \$75 billion acquisition of Activision Blizzard Inc. It appears FTC Chair Lina Kahn wants to take this one on her self. She has been very outspoken about the power of big tech companies and in a recent CNBC interview suggested that the U.S. government's actions were a meaningful contributor to curbing Microsoft's power in the 1990s. We found that a bit dubious. Just ask Netscape, Wordperfect, Novell, Lotus and SPC how effective the government was in curbing Microsoft's power. Generally, our belief is that the U.S. government has had a dismal record regulating big tech companies – most notably IBM Corp. and Microsoft. In our view, market forces, company hubris, complacency and self-inflicted wounds, not government intervention, were far more effective than the government at leveling the playing field. Now, of course, if companies are breaking the law, they should be punished. But the U.S. government hasn't been very productive in its actions and the unintended consequences of regulation could be detrimental to U.S. competitiveness in the race with China.

1.3 AWS

Lastly in the news, Amazon.com Inc. announced earnings on Thursday and the company's value rose \$191 billion the next day, a record single-day increase in valuation for U.S. stocks. AWS grew revenue 40% year-over-year in the quarter. It closed the

year at \$62 billion and a \$71 billion revenue run rate. AWS is now larger than IBM, which without Kyndryl is at a \$67 billion run rate. IBM revenue was \$107 billion in 2011. There's a conversation going on in the media and social that in order to continue this growth and compete with Microsoft, AWS has to get into the SaaS business and offer applications. We don't think that's the right strategy for Amazon in the near future. Rather, we see them enabling developers to compete and build out SaaS offerings. Finally, Amazon disclosed that 48 of its top 50 customers are using Graviton2 instances. Why is this important? Because AWS is well ahead of the competition in custom silicon chips and is on a price performance curve that is far better than alternatives based on x86. This is one of the reasons why this business is not a race to the bottom. AWS' moves in silicon are being followed by Google, Microsoft and Alibaba and this will continue to drive down their internal cost structures and deliver price/performance equal to or better than historical Moore's Law curves.

2. SURVEY ANALYSIS

Let's take a look at how the year ended for the big 4 hyperscalers and look ahead to next year. It is shown in Table 1.

\$B	2018	2019	2020	2021	2022 (E)
AWS	\$25.7	\$35.0	\$45.4	\$62.3	\$84.7B
Azure	\$10.5	\$17.4	\$26.3	\$38.5	\$54.7B
BABA	\$3.1	\$5.2	\$8.1	\$10.8 (E)	\$14.0
GCP	\$1.8	\$3.4	\$5.7	\$8.8	\$12.6B
Total	41.1	\$61.0	\$85.5	\$120.4	\$166.0

Look Ahead to 2022

- Big 4 = \$166B in 2022
- ~38% \$ Growth in 2022
- AWS will approach a \$100B run rate business in 2022
- Slightly trimmed our GCP #'s
- Ecosystem beginning to build "superclouds" on top of hyperscale infrastructure

Source: Wikibon 2/2022 based on company earnings reports & ETR survey data. *Currency fluctuations & rounding may create variance from reported financials

Table 1: Big 4 Cloud Revenue Estimates - IaaS &PaaS

The table above shows revenue estimates for worldwide IaaS and platform-as-a-service generated by AWS, Microsoft, Alibaba and Google. Remember, Amazon and Alibaba share clean IaaS figures whereas Microsoft and Alphabet only give us nuggets that we have to interpret. We then correlate those tidbits with other data we gather. We're one of the few outlets that actually attempts to make these apples-to-apples comparisons. Synergy Research is another firm that tracks this data and makes it public, but we can't map to their numbers. Synergy's GCP figures look high and Azure appears somewhat overestimated. And it includes other sectors such as hosted private cloud services, but it's another datapoint you can use. Coming back to the table above: We've slightly adjusted our GCP figures downward based on comparing some of Alphabet's statements in recent quarters and other survey data that caused us to be less sanguine. Only Alibaba has yet to announce earnings so we'll stick to a 2021 market size of about \$120 billion at a 41% growth rate relative to 2020. We expect that figure to increase by 38% to \$166 billion in 2022. These four companies have created an opportunity for the ecosystem to build what we're calling superclouds on top of this infrastructure. We're seeing it happen. It was increasingly obvious at AWS re:Invent and we feel it will pick up momentum in the coming months and years. More on that later. The chart in figure 1 shows a graphical view of the quarterly revenue shares for these four companies.

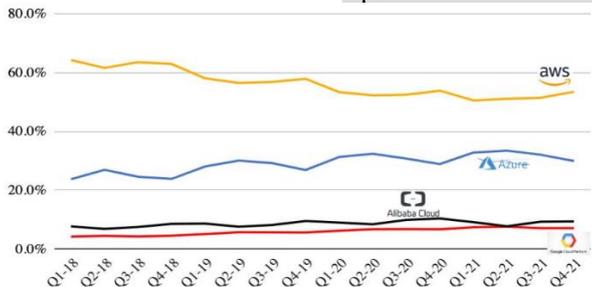


Fig. 1: Hyperscaler Revenue Share IaaS & PaaS

Notice that AWS has reversed its share erosion and is trending up slightly. AWS has accelerated its growth rate four quarters in a row now. It accounted for 52% of the big four hyperscale revenue last year and that figure was nearly 54% in the fourth quarter. Azure finished the year with 32% of hyperscale revenue in 2021, which dropped to 30% in Q4. And you can see GCP and Alibaba are neck-and-neck fighting for the bronze medal. Notably, in our recent 2022 predictions we said Google Cloud Platform would surpass Alibaba this year, but given the recent trimming of our numbers, Google has some work to do for that prediction to come true. To tie up the Wikibon market data, let's look at quarterly growth rates in the chart shown in figure 2 and you'll see the compression trends.

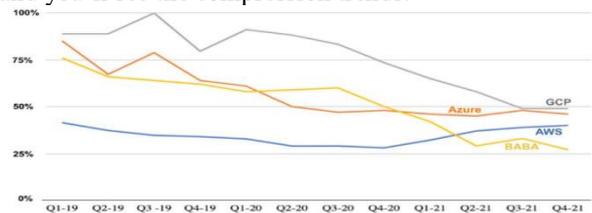


Fig. 2: Hyperscaler Revenue Growth Rates

The data above tracks quarterly revenue growth rates back to Q1 2019 and you can see the steady downward trajectory and the reversal that AWS experienced in Q1 of last year. Now, remember Microsoft guided for sequential growth in Azure, so that orange line should trend back up. And given GCP's much smaller and big go-to-market investments, we'd like to see acceleration there as well. The performance of AWS is remarkable in that the company is able to accelerate growth in a \$71 billion run-rate business. Alibaba is a bit more opaque and is likely still reeling from the crackdown of the Chinese government on big tech. We're admittedly not as close to the China market, but we'll continue to watch from afar, as that steep decline in growth rate is a concern.

3. OBSERVATIONS, DISCUSSIONS AND RECOMMENDATIONS

The chart below shows time series data on some of the select cloud platforms that are showing spending momentum in the ETR data set. ETR uses a metric called Net Score to measure that spending velocity of products and services. Net Score basically asks customers are you spending more, less or the same on a platform? And it subtracts the lesses from the mores and that yields a Net Score.

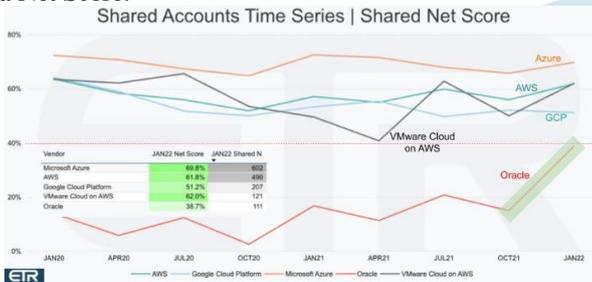


Fig.3: Spending Momentum on Select Cloud Platforms

Figure 3 shows Net Score for five cloud platforms going back to January 2020. Note the table that we've inserted. It shows Net Score and Shared N. The latter indicates the number of mentions in the data set and all the platforms we've listed here show a strong presence in the survey. The red dotted line at 40% indicates spending is at an elevated level. You can see Azure, AWS and VMware Cloud on AWS, as well as GCP are all nicely elevated and bouncing off their October figures, indicating continued cloud momentum overall. But the big surprise in Figure 3 is the steady climb and the steep upward momentum from Oracle Corp., which came in just under the 40% mark. Of course, one quarter is not necessarily a trend but going back to January 2020, the Oracle peaks keep getting higher and higher. So we definitely will keep watching this. The chart in Figure 4 shows the same time series view for some of the other cloud platforms in the ETR survey.

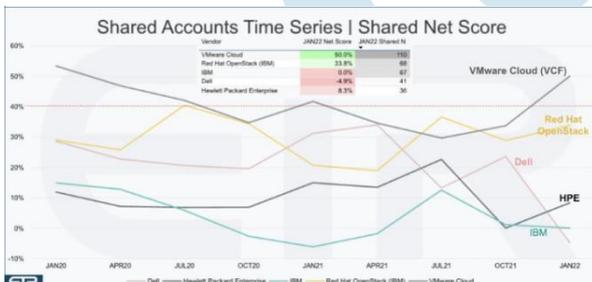


Fig.4: Spending Momentum for Hybrid Cloud Solutions

In the chart, we've now brought in some of the big hybrid players, notably VMware Cloud, which is VCF and other on-prem solutions. Red Hat OpenStack is still popular in telcos that want to build their own cloud. We're also starting to see Hewlett Packard Enterprise Co. with GreenLake and Dell Technologies Inc. with Apex show up more. IBM, which years ago acquired SoftLayer, which was largely a bare-metal hosting company, has leveraged that platform to cobble together its own public cloud. Having largely missed the cloud wave, IBM is now racing after hybrid cloud using Red Hat OpenShift as the linchpin to its strategy. What this data tells us is that, first of all, these platforms don't have the same presence in the data set as do the previous players. VMware Inc. is the one possible exception with a Shared N of 110. Other than VMware, these players don't have the spending velocity shown in the previous chart and most are below the red line. HPE and Dell are interesting. They're transitioning early private cloud businesses to GreenLake and Apex, respectively. And finally, after years of staring at their respective navels in cloud and milking legacy on-prem models, they're building out cloudlike infrastructure, services and pricing models for their customers. They're leaning into the cloud and marketing it in a more sensible and attractive fashion. As such, we expect these figures to bounce around for those two as they transition installed bases and finally settle into a groove swing. We'll continue watch that closely as well. The company is in the process of a major do-over. Chief Executive Arvind Krishna inherited three generations of leadership with a professional services mindset. In the post-Lou Gerstner era, both Sam Palmisano and Ginni Rometty held on far too long to IBM's service heritage and protected the past from the future, missing the cloud opportunity and forcing the acquisition of Red Hat to position the company for the hybrid cloud wars. Rometty tried to shrink to grow but never got there. Krishna is moving faster to rip off the Band-Aid and, with the Kyndryl spin, is promising mid-single-digit revenue growth, which would be a welcome change. IBM has a lot of work to do and we would expect its Net Score figures as well to bounce around as customer's transition to the future.

Let's take a look at all these players in a different context.



Fig.5:Peer Position for Cloud Vendors- Big Move up by Oracle

The chart in Figure 5 plots all the clouds we just mentioned but in a two-dimensional view. The vertical axis is Net Score or spending velocity and the horizontal axis is Market Share or pervasiveness in the data set. There are a few key callouts we'd like to make here:

- The data confirms what we've said for a while: AWS and Microsoft stand alone with a huge presence, many tens of billions in revenue – yet they are both well above the 40% line and noticeably ahead of GCP on both dimensions.
- VMware, while much smaller, is showing legitimate momentum, which correlates to its public statements.
- Alibaba doesn't really have a big sample in the survey and you can see HPE, Dell and IBM have some work to do but are starting to show a bigger presence in the survey. But the spending momentum is still not there when compared to the leaders.
- Oracle is the big surprise. Look where Oracle was in the January survey and how they've shot up recently.

See in the Figure 6, Oracle's position on the quadrant is right there with AWS and Microsoft, and ahead of Google. On the right hand side is Gartner's critical capabilities ratings for database management systems in operational use cases. Oracle leads in virtually all the categories Gartner tracked. The graph above shows traditional transactions, but Gartner has Oracle ahead of all vendors in stream processing, operational intelligence and real-time augmented transactions.



Fig. 6: Magic Quadrant for Cloud Database Management Systems

Now, Gartner is like old mainframers – and we say that lovingly – so maybe it's a bit biased and might be missing some of the emerging opportunities that, for example, Snowflake is pioneering. But it's hard to deny that Oracle, for its business, is making the right moves in cloud by optimizing for the red stack. There's little question of that, in our view, and when it comes to mission-critical, we think Gartner's analysis is correct. There's a really exciting landscape emerging in cloud data. Snowflake calls it the data cloud, ZhamakDehghani calls it data mesh, others call it data fabric, Databricks calls it data lakehouse, and so does Oracle. Below is a more comprehensive view of the same companies. We expand the picture with the two dimensions of Net Score on the Y axis and Market Share or pervasiveness on the horizontal axis.



Fig.5: Database/ Data Warehouse in Cloud Accounts

The table insert informs the position of the dots – Net Score on the Y and Shared N driving the X axis. There's not much to add here other than to say the picture continues to look strong for those companies above the 40% line that are focused, relatively

new and have figured out a clear cloud strategy. The ones below the line definitely have parts of their portfolio which show solid momentum, but they're fighting the inertia of a large installed base that moves slowly.

4 CONCLUSION AND FUTURE WORK

Cloud ecosystems generally and AWS' specifically are exploding. This idea of supercloud that is a layer of value that spans multiple clouds and hides the underlying complexity is starting to bubble to the top. Legacy players are staying close to their customers and fighting to keep them spending and its working. Dell, HPE, Cisco Systems Inc. and smaller predominantly on-prem players such as Pure Storage Inc. continue to do relatively well. They're just not as sexy as the big cloud players.

The real interesting activity is happening in the ecosystem of firms within industries that are transforming to create their own digital businesses. Virtually all of them are running a portion of their offerings in the public cloud – but often connecting to on-premises workloads and data. Making that work and creating a great experience across all environments is a large opportunity and we're seeing it form right before our eyes.

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