October 26, 2022 04:01 AM GMT

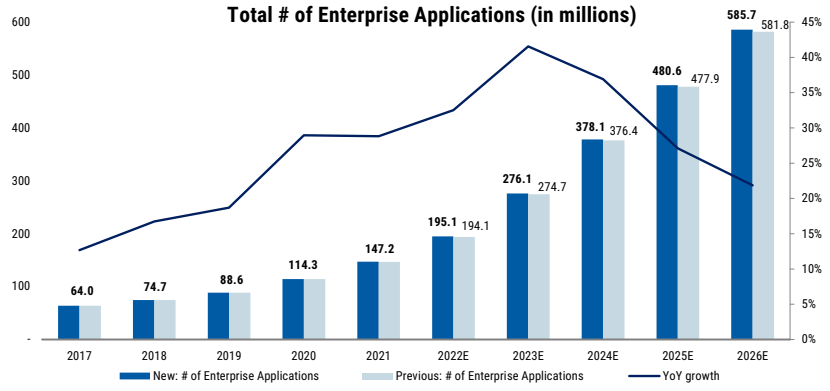
Software | North America

What's New in the 'New Stack'? Updating Our Sever Workload Model

Better than expect server shipments result in a modest increase to our enterprise application forecast. While NT spending in infra sw is slowing the LT drivers from cloud and new app development appear intact, which should support growth across a number of product markets.

Better Than Expected Server Shipments Result in a Modest Upward Revisions to Our Enterprise Application Forecast. The core building block of our Server Workload model is growth in the physical server installed base, which is based on two inputs: 1) the Morgan Stanley U.S. IT Hardware team's server shipment forecast, and 2) IDC's server installed base tracker. Due to strong Q3 data, both of these inputs were recently revised higher. First, our IT Hardware team (lead by Erik Woodring) increased their server shipment estimates by ~8% in FY22 and raised outer years on average by ~4.5% (FY23-FY25). In addition, IDC restated historical data in its server installed base tracker and lifted forward year estimates. After applying the historical server count from IDC and the new updates for server shipments from the Morgan Stanley IT Hardware team, our total physical server installed base increased by 6.4% in FY26 to 81 million, from our prior estimate of 76 million. Flowing through the increased infrastructure capacity in our model, we now estimate the total # of enterprise applications to reach 586 million in 2026, up 0.7% from our previous estimate of 582 million in our August New Stack report.

Exhibit 1: Number of Enterprise Applications Growing at ~32% CAGR, Set to Reach 586 Million in 2026



Source: Morgan Stanley Research estimates, IDC

MORGAN STANLEY & CO. LLC

Sanjit K Singh
EQUITY ANALYST
Sanjit.Singh@morganstanley.com +1 415 576-2060

Keith Weiss, CFA
EQUITY ANALYST
Keith.Weiss@morganstanley.com +1 212 761-4149

Erik W Woodring
EQUITY ANALYST
Erik.Woodring@morganstanley.com +1 212 296-8083

Matthew T Wilson
RESEARCH ASSOCIATE
Matt.Wilson@morganstanley.com +1 212 761-7659

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How Sensitive is Our Model to Changes in the Physical Server Installed Base?

For every 100 bps change in our server installed base CAGR ('21-'26), our forecast for growth in the number of enterprise applications changes by about 50 bps (Exhibit 2). Forecasting growth in the server installed base is the first layer in our analysis to forecast enterprise applications, which takes a bottoms up approach to assess the compute capacity available to support the growth in enterprise applications. The growth in servers is driven by the ongoing shift of workloads to the public cloud, adoption of new application architectures and application development methodologies (Agile, DevOps, DevSecOps). These modern technologies are enabling more enterprise work flows to become digitalized, fulfilling business mandates to digitally transform. An attractive secular outlook for enterprise applications serves as the foundation for sustained investment across several key New Stack product markets including: the application platform market, operational databases, DevOps software, observability and cloud security. As we highlighted in our August 2022 New Stack report, we become increasingly convicted in the multi-year growth trajectory of top ideas with exposure to one or more of these markets, including: Microsoft, ServiceNow, Palo Alto Networks, IBM (covered by Erik Woodring), Atlassian, MongoDB and Datadog. Please see our presentation highlighting our key findings from our server workload model update, see **Presentation of Our Finding from Our Server Workload Model Update**.

Exhibit 2: A 100 bps Change in Installed Server CAGR Impacts # of Enterprise Applications by 50 bps

Scenario	Physical Server CAGR ('21-'26e)	# of Physical Servers (2026e)	# of Enterprise Applications (2026e)	CAGR ('22-'26e) in Enterprise Applications	Change in # of Enterprise Applications	% Change
-300 bps	4.2%	70,285,284	577,171,431	31.4%	**-8,514,456**	**-1.45%**
-200 bps	5.2%	73,722,904	579,902,729	31.5%	**-5,783,158**	**-0.99%**
-100 bps	6.2%	77,293,733	582,739,865	31.7%	**-2,946,022**	**-0.50%**
Base Case	7.2%	81,001,606	585,685,887	31.8%		
+100 bps	8.2%	84,850,430	588,743,899	31.9%	**3,058,012**	**0.52%**
+200 bps	9.2%	88,844,185	591,917,063	32.1%	**6,231,177**	**1.06%**
+300 bps	10.2%	92,986,928	595,208,603	32.2%	**9,522,716**	**1.63%**

Source: Morgan Stanley Research estimates

Exhibit 3: Server Workload Model: New vs. Old Estimates

(in millions)

MS Global Enterprise Workload Model	2021	2022E	2023E	2024E	2025E	2026E
Physical Server Shipments	14,466,907	15,646,232	16,166,248	16,987,982	17,978,615	18,847,230
YoY Growth	*10.0%*	*8.2%*	*3.3%*	*5.1%*	*5.8%*	*4.8%*
Previous - Physical Server Shipments	13,538,585	14,451,289	15,369,573	16,493,418	17,055,549	17,815,226
Previous - YoY Growth	*6.9%*	*6.7%*	*6.4%*	*7.3%*	*6.0%*	*6.0%*
Change (%)	*6.9%*	*8.3%*	*5.2%*	*3.0%*	*5.4%*	*5.8%*
Physical Server Installed Base	57,188,356	62,254,742	66,903,863	71,514,630	76,263,039	81,001,606
YoY Growth	*9.3%*	*8.9%*	*7.5%*	*6.9%*	*6.6%*	*6.2%*
Previous - Physical Server Installed Base	55,773,754	59,919,645	64,217,778	68,845,584	72,485,106	76,145,072
Previous - YoY Growth	*7.7%*	*7.4%*	*7.2%*	*7.2%*	*5.3%*	*5.0%*
Change (%)	*2.5%*	*3.9%*	*4.2%*	*3.9%*	*5.2%*	*6.4%*
Total # of Hosts	365,487,723	427,706,810	492,192,659	561,277,857	631,163,375	694,622,662
YoY Growth	*18.6%*	*17.0%*	*15.1%*	*14.0%*	*12.5%*	*10.1%*
Previous - Total # of Hosts	364,073,121	425,371,714	489,506,575	558,608,811	627,385,442	689,766,128
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Total # of Container Instances	1,441,211,514	2,042,942,356	2,968,235,294	4,136,010,669	5,328,748,305	6,435,471,926
YoY Growth	*42.2%*	*41.8%*	*45.3%*	*39.3%*	*28.8%*	*20.8%*
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YoY Growth	***28.8%***	***32.5%***	***41.6%***	***36.9%***	***27.1%***	***21.9%***
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Source: Morgan Stanley Research estimates

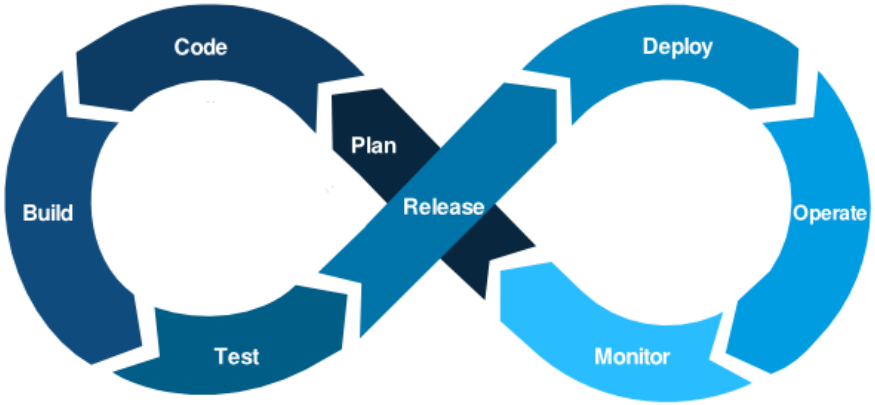
Presentation of the Findings from Our Server Workload Model Update

Software

Morgan Stanley

October 2022

What's New in the 'New Stack'?



Server Workload Model Update: Growth in the Enterprise Applications to Remain Robust Thru 2026

Sanjit Singh
sanjit.singh@morganstanley.com
(415) 576 2060

Keith Weiss
keith.weiss@morganstanley.com
(212) 761 4149

Matt Wilson
matt.wilson@morganstanley.com
(212) 761 7659

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Part I

Updating Our Server Workload Model

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Part I: Updating Our Server Workload Model

Server Workload Model Update: Now Expecting 586M Enterprise Apps in 2026

Our Server Workload Model, last updated during our October 2022 New Stack Report, relies on physical server estimates as the first step in our bottom-up analysis to estimate the number of enterprise applications. Two sources for our physical server build includes: 1) Morgan Stanley's US IT Hardware Research team server shipment forecast, which was recently revised upwards, and 2) IDC Physical Server Installed Base Tracker, which was updated last week.

How Did Physical Server Inputs to Our Model Change?

- The Morgan Stanley's US IT Hardware Research team, lead by Erik Woodring, revised physical server shipment estimates by as much as ~8% in FY22, with ~5% annual revisions on average between FY23-FY25.
  - The estimate revisions were based on updated historical data (2Q22) from IDC, which pointed to stronger YoY growth in Linux based servers (+21% Y/Y vs. MSe of 9% Y/Y) and IBM z/OS (46% Y/Y vs. 44% MSe).
- Additionally, IDC updated it's physical server installed base tracker. IDC restated historical server data by 0.9%/2.5% in 2020/2021 and increased future server installed base estimates, by an average of ~5% per year in 2022-2026.

What Are The Implications For Our Server Workload Model?

- We increased our physical server estimates in 2020 through 2026. The magnitude of the estimate revision increases by year, starting with a 0.9% increase to previous estimates in 2021 and culminating in a 6.4% increase to estimates in 2026.
- **The flow through:** The impact of increased server count results in a ~3.9 million positive impact to the number of total enterprise applications in 2026. Now forecasting 586 million total enterprise applications, about 70 bps higher than our previous estimate of 582 million.

Source: Morgan Stanley Research estimates, IDC

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Part I: Updating Our Server Workload Model

Server Workload Model Update: New vs. Old Estimates

(in millions)

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Change (%)	*0.4%*	*0.5%*	*0.5%*	*0.5%*	*0.6%*	*0.7%*

Source: Morgan Stanley Research estimates, IDC

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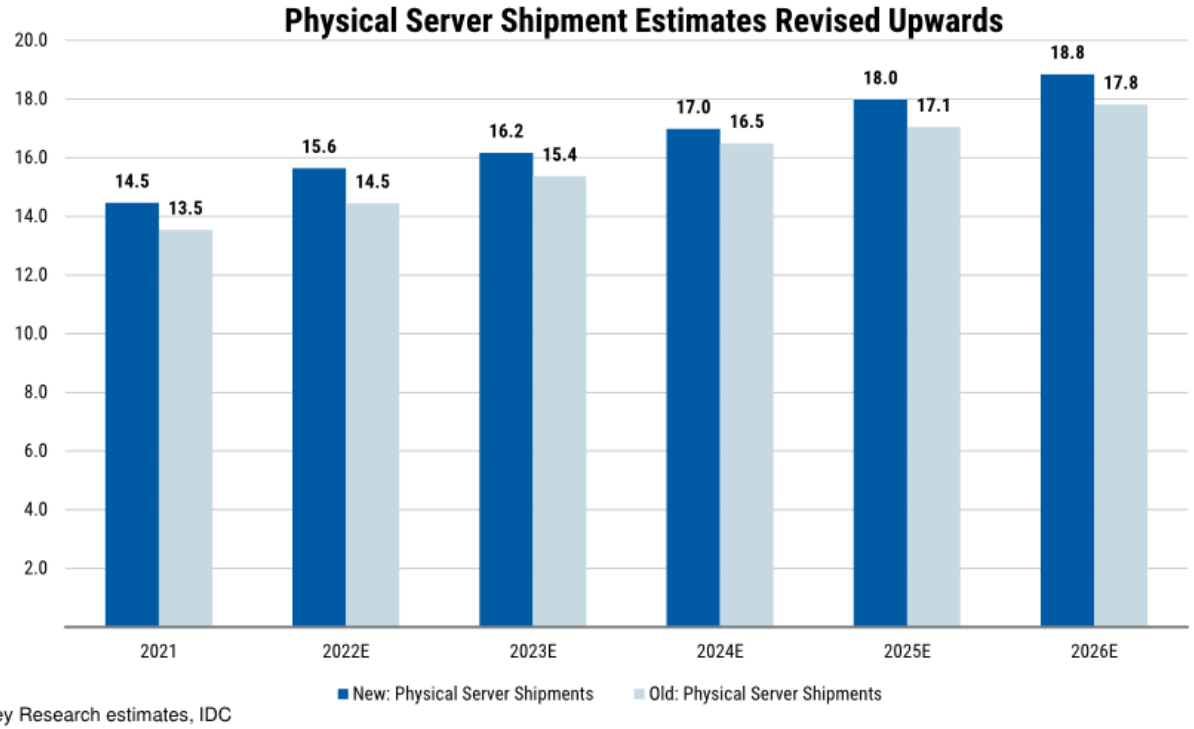
Part I: Updating Our Server Workload Model

Server Shipment Strength in 1H22 Supports New Est. Revisions

Now Forecasting Server Shipments to Reach 18.8 million in 2026, a ~5.8% Increase From Our Prior 17.8 Million Estimate

- **Estimate Changes:** Morgan Stanley U.S. IT Hardware Team server shipment estimates increased by 6.9%/8.3%/5.2%/3.0%/5.4% in FY21 - FY25

- Our Server Workload model extrapolates to FY26, where we estimate growth to decelerate to +4.8% (from 5.8% in FY25 and 6.0% in our prior estimate given tougher comps)



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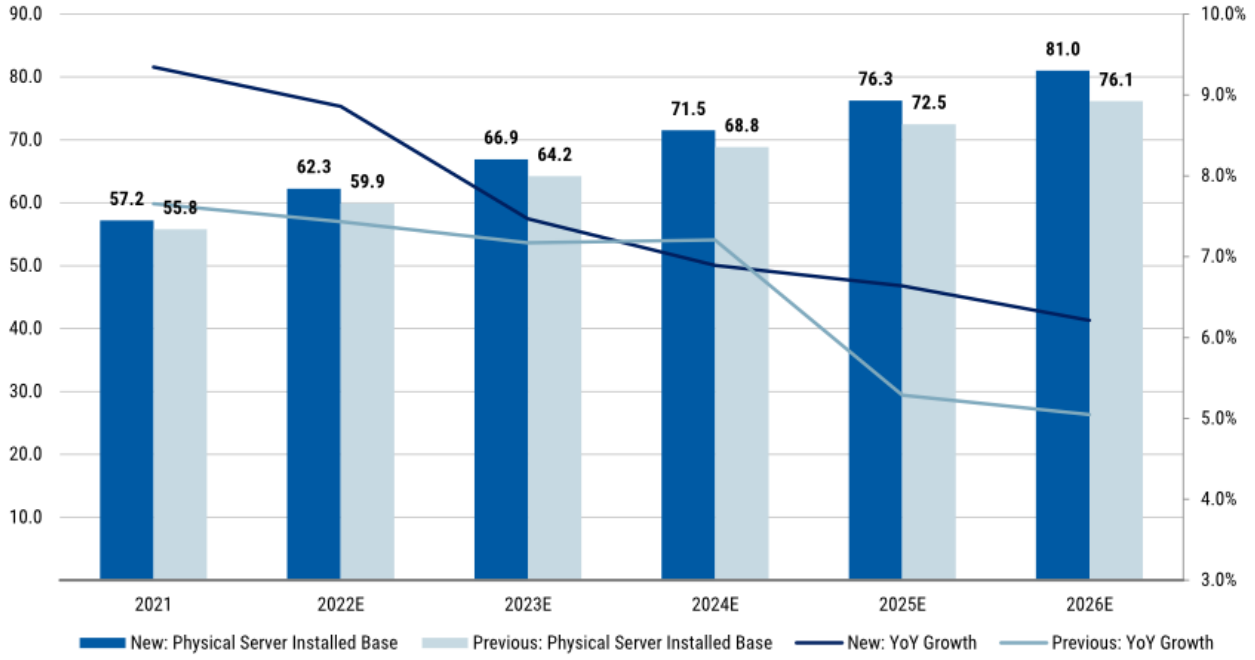
Part I: Updating Our Server Workload Model

Physical Server Installed Base Expected to Reach 81M in 2026

Benefiting From Increased Server Shipment Estimates, Expecting Physical Server Installed Base to Reach 81 Million in 2026, From Prior Estimate of 76 Million

- **Total Server Installed base estimates**: expected to increase to 81.0M (prior est. of 76.1M) from 57.2M (prior est. of 55.8M) in 2021
- Increased estimates attributed to 1) MS U.S. IT Hardware team increasing their server shipment forecast, 2) IDC restating historical physical server installed base data



Source: Morgan Stanley Research estimates, IDC

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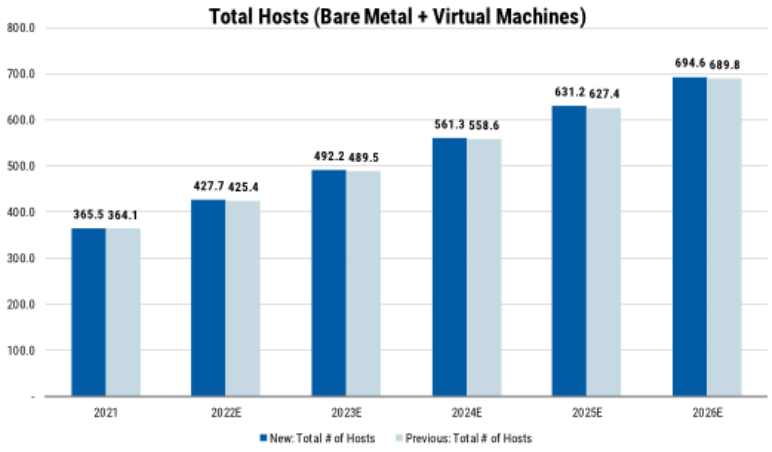
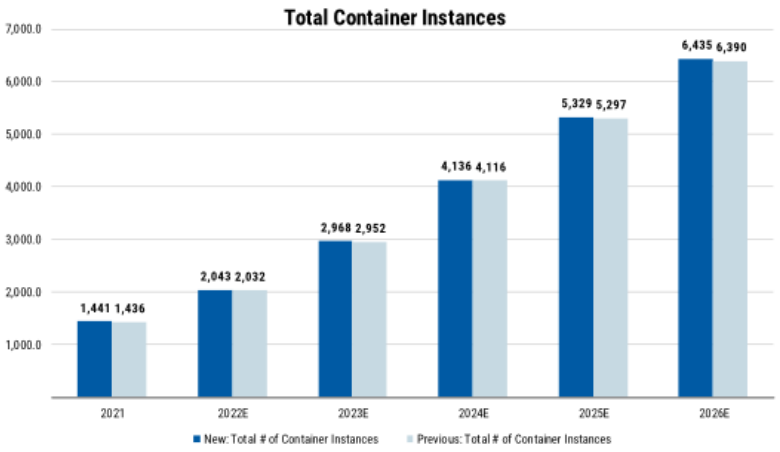
Part I: Updating Our Server Workload Model

Increased Server Count Supports More Host and Container Instances

Now Estimating 695 Million in Total Hosts By 2026; Reflecting a ~70 bps Increase From Our Prior Estimate of 690 Million Hosts

- **Total Hosts:** forecasting 695 million total hosts (enterprise + DSP) by 2026 up from 366 million in 2021, represents a CAGR of ~14%
- **Container Instances:** forecasting 6,435 million total container instances (enterprise + DSP) by 2026 up from 1,441 million in 2021, represents a CAGR of 35%





Source: Morgan Stanley Research estimates, IDC

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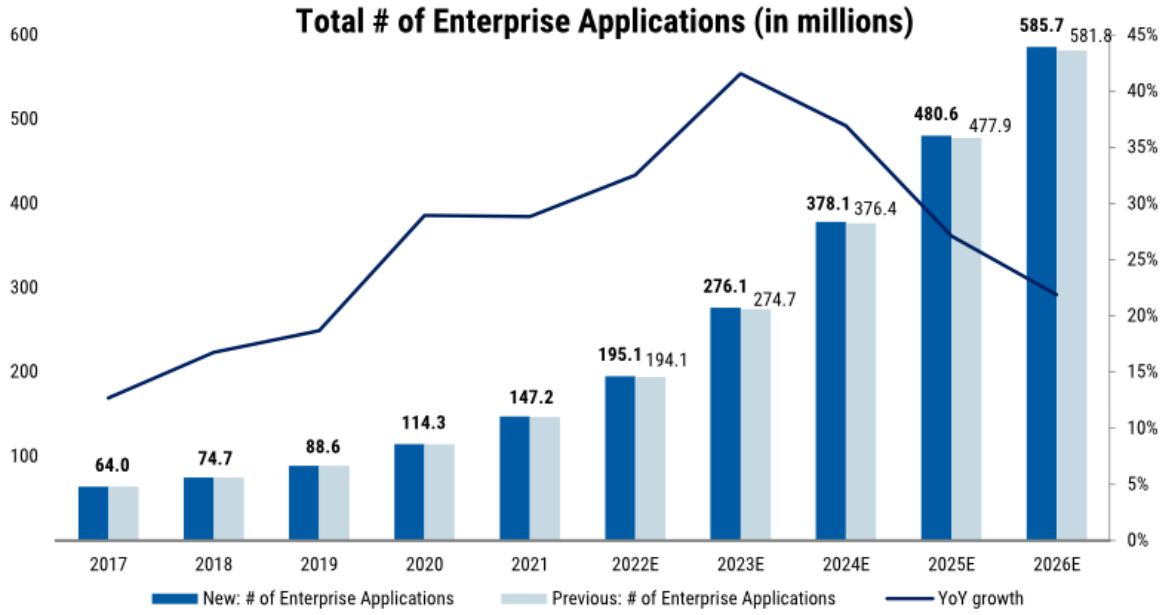
Part I: Updating Our Server Workload Model

Forecasting 586M Enterprise Apps by 2026, Up ~70 BPS From Prior Est.

Forecasting 586 Million Enterprise Apps by 2026; Up From 64 Million In 2017 And Up From 147 Million In 2021

- **Total # of Apps:** 585.7 million total apps by 2026 (previous estimate of 581.8M) up from 149 million in 2021, implying a ~32% CAGR (previous estimate of ~31% CAGR)
- **# of DSP Apps:** 4.3 million internal DSP apps by 2026 (previous estimate of 4.0M) up from 2.5 million in 2021 representing a CAGR of ~12% (previous estimate of ~11% CAGR)



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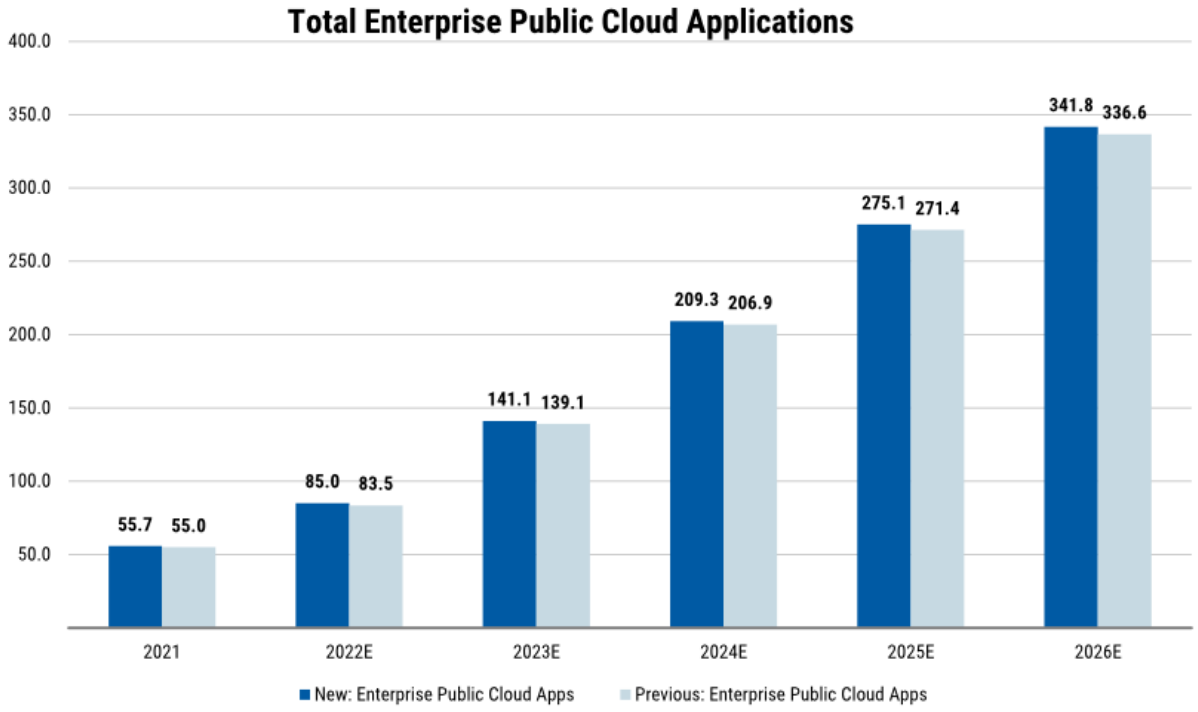
Part I: Updating Our Server Workload Model

Total Enterprise Public Cloud Apps Growing at ~44% CAGR

In terms of Public Cloud Application, We Estimate 342 Million Enterprise Public Cloud Apps By 2026, Up From 56 Million in 2021, Representing a CAGR of ~44%

- **Enterprise Public Cloud App Estimate Changes:** 342 million enterprise public cloud apps in 2026 represents a ~70 bps increased from prior estimate of 337 million



Source: Morgan Stanley Research estimates, IDC

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Part I: Updating Our Server Workload Model

Magnitude of Changes To Server Estimates on Our Application Forecast?

All Else Equal, a 100 bps Change in Physical Server Installed Base CAGR Represents a ~50 bps Change to Total Enterprise Applications

- **Base Case Scenario:** physical server installed based reaches 81 million in 2026, representing a ~7.2% CAGR ('21-'26). This yields 586 million enterprise applications
- **+100 bps Adjustment to Server Installed Base CAGR:** an ~8.2% CAGR in physical server installed base yields 589 million in enterprise application in 2026, a 52 bps increase from our base case scenario
- **-100 bps Adjustment to Server Installed Base CAGR:** an ~6.2% CAGR in physical server installed base yields 583 million in enterprise application in 2026, a 50 bps increase from our base case scenario

	Input Flexed		Output		Impact	
Scenario	Physical Server CAGR ('21-'26e)	# of Physical Servers (2026e)	# of Enterprise Applications (2026e)	CAGR ('22-'26e) in Enterprise Applications	Change in # of Enterprise Applications	% Change
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Part II

Key Takeaways From Our Enterprise Application Forecast

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Part II: Key Takeaways From Our Enterprise Application Forecast

Key Takeaways From Our Server Workload Model

Our Updated Server Workload Model Forecasts 586+ Million Enterprise Applications by 2026

- **Implies 32% Annualized Growth:** based on an estimate of ~147 million enterprise apps in 2021
- While we increased estimates slightly and project robust growth, we think our estimates could prove conservative
- For example, IDC conducted a similar analysis and forecasts 750 million cloud-native application alone and over ***1 billion total applications by 2025***

Growth in Enterprise Applications Fueled by Apps Deployed in the Public Cloud

- **44% CAGR:** thru 2026 in the # of public cloud apps to 342 million from 56 million in 2021
- **Public Cloud Mix Reaches 58%:** by 2026 from 38% in 2021 and from 14% in 2016
- On-premise/non-public cloud apps to growth at a 22% CAGR thru 2026 to 244 million

Strong Growth in Application Enabled by Adoption of Modern Infrastructure & App Architectures

- **Growth in # of Hosts:** 14% CAGR thru 2026 to ~695 million from 365 million in 2021
- **Growth in Enterprise Container Instances:** 56% CAGR thru 2026 to ~3.1 billion instances
- Supports 445 Million Cloud-native apps in 2026 up from 48 million in 2021, a 56% CAGR

Source: Morgan Stanley Research estimates, IDC

Morgan Stanley

Part II: Key Takeaways From Our Enterprise Application Forecast

What End Markets Benefit From Growth in Enterprise Applications?

A Healthy Outlook for the Number of Enterprise Apps Going Forward Should Support Sustained Investment Across Several New Stack Product Markets, Including…

1. **Application Platform Market:** Strong growth in the number of logical applications supports both professional developer application development platforms, as well as in low-code platforms
   - Market Size & Growth: $21B in 2021 → $47B by 2026; 18% CAGR
2. **Operational Database Market:** Nearly every application requires a database, implying an extremely high attach rate of databases to the installed base of logical applications
   - Market Size & Growth: $40B in 2021 → $68B by 2026; 11% CAGR
3. **DevOps Market:** Benefits from both the strong expected growth in enterprise applications and a tight labor market, which drive the need for automation/increased efficiencies
   - Market Size & Growth: $16B in 2021 → $29B by 2026; 12% CAGR
4. **Observability Market:** Benefits from several secular forces including: 1) the shift of application workloads to the cloud; 2) adoption of cloud-native application architectures; and 3) strong expected growth in digital apps and services
   - Market Size & Growth: $15B in 2021 → $24B by 2026; 10% CAGR
5. **Security Market:** The growth in the number of cloud-native applications deployed in the public cloud (58% CAGR thru 2026) opens up a new frontier in the security market as the dynamic nature of the underlying infrastructure requires new capabilities and new architectural approaches to secure this modern class of applications
   - Market Size & Growth (Cloud): $44B in 2021 → $93B by 2026; 16% CAGR

Source: Morgan Stanley Research estimates, IDC

Part II: Key Takeaways From Our Enterprise Application Forecast

Best Stocks to Gain Exposure to the Secular Growth in Enterprise Apps

1. **Application Platform Market:**
   - Top Ideas: Microsoft, IBM, ServiceNow
   - Other Ways to Play: Akamai, Appian, Amazon AWS, C3.ai, Cloudflare, Confluent, Digital Ocean, Fastly, Google Cloud, Palantir, Pegasystems, Salesforce, UiPath
2. **Operational Database Market:**
   - Top Ideas: Microsoft, MongoDB
   - Other Ways to Play: Amazon AWS, Couchbase, Google Cloud, Oracle, SAP Snowflake
3. **DevOps Market:**
   - Top Idea: Atlassian
   - Other Ways to Play: Amazon AWS, GitLab, HashiCorp, JFrog, Microsoft, Palantir
4. **Observability Market:**
   - Top Idea: Datadog
   - Other Ways to Play: Cisco, Dynatrace, Elastic, New Relic, PagerDuty, Splunk, Sumo Logic, PagerDuty
5. **Cloud Security Market:**
   - Top Idea: Palo Alto Networks
   - Other Ways to Play: CrowdStrike, Datadog, Dynatrace, Elastic, SentinelOne, Sumo Logic, Zscaler
6. **Other Beneficiaries:** Amplitude, WalkMe

Source: Morgan Stanley Research estimates, IDC

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Part III

Server Workload Model

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Part III: Server Workload Model

Server Forecast: ~8% CAGR ('21-'26e) in Physical Servers

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Server Model								
Physical Server Installed Base	**52,299,909**	**57,188,356**	**62,254,742**	**66,903,863**	**71,514,630**	**76,263,039**	**81,001,606**	**8%**
YoY growth	7%	9.3%	8.9%	7.5%	6.9%	6.6%	6.2%	
x86 Server Installed Base	**50,928,270**	**54,248,642**	**57,582,455**	**60,601,055**	**63,548,751**	**66,092,243**	**68,629,719**	**5%**
YoY growth	5%	7%	6.1%	5.2%	4.9%	4.0%	3.8%	
% of new Shipments virtualized	52%	59%	60%	61%	62%	63%	64%	
% x86 Installed Base Virtualized	47%	50%	53%	56%	58%	61%	62%	
Breakout #1: Virtualized vs. Non-Virtualized								
Virtualized Server Installed Base	23,812,465	27,214,556	30,623,163	33,851,807	37,071,604	39,985,807	42,207,277	**11%**
YoY growth	12%	14%	13%	11%	10%	8%	6%	
Non-Virtualized Server Installed Base	28,487,444	29,973,800	31,631,579	33,052,056	34,443,026	36,277,232	38,794,329	**5%**
YoY growth	3%	5%	6%	4%	4%	5%	7%	
Breakout #2: Public Cloud vs. On-premise / Private Cloud								
Public Cloud Server Installed Base	**9,175,855**	**11,232,994**	**13,273,026**	**15,552,915**	**18,034,209**	**20,519,266**	**22,664,935**	**15%**
YoY growth	18%	22%	18%	17%	16%	14%	10%	
% of New Shipments	20.4%	24.1%	26.1%	27.2%	28.2%	28.8%	29.5%	
% of total server installed base	17.5%	19.6%	21.3%	23.2%	25.2%	26.9%	28.0%	
On-premise / Private Cloud Server Installed Base	**43,124,054**	**45,955,362**	**48,981,716**	**51,350,948**	**53,480,421**	**55,743,772**	**58,336,671**	**5%**
YoY growth	5%	7%	7%	5%	4%	4%	5%	
% of total server installed base	82%	80%	79%	77%	75%	73%	72%	

Source: Morgan Stanley Research estimates, IDC, Forrester

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Part III: Server Workload Model

Host Forecast: VM Growth Underpins +14% CAGR in # of Hosts

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Host Forecast								
Forecast: Virtual Machines								
Assumption: VMs per Virtualized Server (New Shipments)	12.9	13.6	14.2	14.9	15.5	16.2	16.9	
Assumption: # of VMs per Virtualized Server	11.7	12.3	12.9	13.6	14.2	14.9	15.5	
Total # of Virtual Machines	**279,567,940**	**335,513,923**	**396,075,231**	**459,140,604**	**526,834,831**	**594,886,143**	**655,828,334**	**17%**
Virtualization Penetration %	91%	92%	93%	93%	94%	94%	94%	
Virtual Machine Breakout								
# of Virtual Machines Not Running Containers	248,516,297	291,437,506	329,565,936	354,700,826	376,143,416	401,738,197	423,441,620	**8%**
% of total hosts	*80.7%*	*79.7%*	*77.1%*	*72.1%*	*67.0%*	*63.7%*	*61.0%*	
# of Virtual Machines Running Containers	31,051,643	44,076,417	66,509,295	104,439,778	150,691,416	193,147,946	232,386,714	**39%**
Forecast: Container Hosts								
Breakout #1: DSP Internal vs. Enterprise Container Hosts								
DSP Internal Hosts	29,340,362	38,704,019	49,505,087	61,652,357	75,816,878	89,738,393	99,824,329	**21%**
YoY Growth	29%	32%	28%	25%	23%	18%	11%	
% of Container Hosts	66%	62%	57%	48%	43%	40%	38%	
Enterprise Hosts	14,832,761	23,442,565	38,035,959	66,631,322	101,678,606	133,023,427	163,883,800	**48%**
YoY Growth	125%	58%	62%	75%	53%	31%	23%	
% of Container Hosts	34%	38%	43%	52%	57%	60%	62%	
Breakout #2: Virtual vs. Bare Metal Container Hosts								
Virtualized Container Hosts	31,051,643	44,076,417	66,509,295	104,439,778	150,691,416	193,147,946	232,386,714	**39%**
Bare Metal Container Hosts	13,121,480	18,070,168	21,031,751	23,843,901	26,804,069	29,613,873	31,321,416	**12%**
% Virtualized	70%	71%	76%	81%	85%	87%	88%	
% Bare Metal	30%	29%	24%	19%	15%	13%	12%	
Total # of Container Hosts	**44,173,123**	**62,146,584**	**87,541,046**	**128,283,679**	**177,495,485**	**222,761,820**	**263,708,130**	**34%**
YoY Growth	51%	41%	41%	47%	38%	26%	18%	
% of Total Hosts	14%	17%	20%	26%	32%	35%	38%	
Bare Metal Server Breakout								
Total # of Bare Metal Hosts	**28,487,444**	**29,973,800**	**31,631,579**	**33,052,056**	**34,443,026**	**36,277,232**	**38,794,329**	**5%**
YoY Growth	3%	5%	6%	4%	4%	5%	7%	
% of total hosts	9.2%	8.2%	7.4%	6.7%	6.1%	5.7%	5.6%	
% of Bare Metal Running Containers	*46%*	*60%*	*66%*	*72%*	*78%*	*82%*	*81%*	
% of Bare Metal Not Running Containers	*54%*	*40%*	*34%*	*28%*	*22%*	*18%*	*19%*	
Total # of Hosts	**308,055,383**	**365,487,723**	**427,706,810**	**492,192,659**	**561,277,857**	**631,163,375**	**694,622,662**	**14%**
YoY growth	16.0%	18.6%	17.0%	15.1%	14.0%	12.5%	10.1%	
% of total hosts	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Source: Morgan Stanley Research estimates, IDC

Morgan Stanley

Part III: Server Workload Model

Container Forecast: Container Instances Expected to Increase 4.5x by 2026

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Container Instances Forecast								
Breakout #1: DSP Internal vs. Enterprise Conatiner Instances								
DSP Internal Container Instances	817,115,540	1,104,788,813	1,455,703,892	1,867,458,060	2,366,874,478	2,899,094,800	3,321,679,717	**25%**
YoY Growth	41%	35%	32%	28%	27%	22%	15%	
% of total	80.6%	76.7%	71.3%	62.9%	57.2%	54.4%	51.6%	
Enterprise Container Instances	**196,343,976**	**336,422,701**	**587,238,464**	**1,100,777,234**	**1,769,136,192**	**2,429,653,505**	**3,113,792,209**	**56%**
YoY Growth	146%	71%	75%	87%	61%	37%	28%	
% of total	19.4%	23.3%	28.7%	37.1%	42.8%	45.6%	48.4%	
Breakout #2: Container Instances Running in VMs vs.Bare Metal								
Virtualized Instances	678,173,240	1,016,562,571	1,511,222,052	2,323,196,237	3,372,315,390	4,443,022,859	5,484,389,953	**40%**
YoY Growth	70%	50%	49%	54%	45%	32%	23%	
% of total	67%	71%	74%	78%	82%	83%	85%	
DSP Internal	*509,133,589*	*729,270,337*	*1,009,767,791*	*1,363,783,580*	*1,787,430,180*	*2,247,631,476*	*2,644,233,432*	**29%**
Enterprise	*169,039,651*	*287,292,234*	*501,454,261*	*959,412,657*	*1,584,885,209*	*2,195,391,383*	*2,840,156,521*	**58%**
Bare Metal Instances	335,286,276	424,648,943	531,720,304	645,039,057	763,695,280	885,725,446	951,081,973	**17%**
YoY Growth	29%	27%	25%	21%	18%	16%	7%	
% of total	33%	29%	26%	22%	18%	17%	15%	
DSP Internal	*307,981,950*	*375,518,476*	*445,936,100*	*503,674,480*	*579,444,298*	*651,463,323*	*677,446,285*	**13%**
Enterprise	*27,304,326*	*49,130,468*	*85,784,204*	*141,364,577*	*184,250,982*	*234,262,123*	*273,635,688*	**41%**
Breakout #3: DSP Internal vs. On-Premises Container Instances								
Public Cloud	931,457,005	1,313,384,624	1,832,770,061	2,603,810,358	3,546,694,155	4,500,353,675	5,351,538,987	**32%**
YoY Growth	50%	41%	40%	42%	36%	27%	19%	
% of total	92%	91%	90%	88%	86%	84%	83%	
DSP Internal	*817,115,540*	*1,104,788,813*	*1,455,703,892*	*1,867,458,059*	*2,366,874,478*	*2,899,094,800*	*3,321,679,716*	**25%**
Enterprise	*114,341,465*	*208,595,811*	*377,066,170*	*736,352,299*	*1,179,819,677*	*1,601,258,876*	*2,029,859,271*	**58%**
DSP Internal %	*88%*	*84%*	*79%*	*72%*	*67%*	*64%*	*62%*	
Enterprise %	*12%*	*16%*	*21%*	*28%*	*33%*	*36%*	*38%*	
On-Premise Instances (AKA Enterprise On-premise Instances)	82,002,511	127,826,890	210,172,295	364,424,936	589,316,514	828,394,630	1,083,932,939	**53%**
YoY Growth	105%	56%	64%	73%	62%	41%	31%	
% of total	8%	9%	10%	12%	14%	16%	17%	
Total # of Container Instances	**1,013,459,516**	**1,441,211,514**	**2,042,942,356**	**2,968,235,294**	**4,136,010,669**	**5,328,748,305**	**6,435,471,926**	**35%**
YoY Growth	54%	42%	42%	45%	39%	29%	21%	

Source: Morgan Stanley Research estimates, IDC

Morgan Stanley

Part III: Server Workload Model

Logical Application Forecast: Bare Metal Apps Expected to Decline

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Logical Applications Forecast (Traditional + Cloud Native)								
Forecast: Apps Running on Bare Metal								
# of Workloads per Bare Metal Server	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
# of Bare Metal Servers Not Running Containers	15,365,963	11,903,632	10,599,829	9,208,155	7,638,957	6,663,358	7,472,913	-9%
# of Workloads Running on Bare Metal	15,365,963	11,903,632	10,599,829	9,208,155	7,638,957	6,663,358	7,472,913	-9%
YoY	*-10%*	*-23%*	*-11%*	*-13%*	*-17%*	*-13%*	*12%*	
# of Bare Metal Workloads per Logical App	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Total # of Logical Bare Metal Apps	**5,121,988**	**3,967,877**	**3,533,276**	**3,069,385**	**2,546,319**	**2,221,119**	**2,490,971**	**-9%**
YoY	*-10%*	*-23%*	*-11%*	*-13%*	*-17%*	*-13%*	*12%*	
% of Total Logical applications	4.4%	2.7%	1.8%	1.1%	0.7%	0.5%	0.4%	
Breakout of Bare Metal: DSP Internal vs. Enterprise								
% DSP Internal Bare Metal Workloads	9.6%	11.0%	12.3%	13.8%	15.0%	16.1%	17.1%	
% Enterprise Bare Metal Workloads	90.4%	89.0%	87.7%	86.2%	85.0%	83.9%	82.9%	
# of DSP Internal Bare Metal Workloads	1,482,628	1,311,407	1,306,069	1,272,964	1,149,039	1,071,606	1,279,536	0%
# of Enterprise Bare Metal Workloads	13,883,335	10,592,226	9,293,760	7,935,191	6,489,918	5,591,752	6,193,377	-10%
YoY Growth in DSP Bare Metal Workloads	*1%*	*-12%*	*0%*	*-3%*	*-10%*	*-7%*	*19%*	
YoY Growth in Enterprise Bare Metal Workloads	*-11%*	*-24%*	*-12%*	*-15%*	*-18%*	*-14%*	*11%*	
# of Bare Metal Workloads per Logical App (DSP)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
# of Bare Metal Workloads per Logical App (Enterprise)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Total # of DSP Internal Logical Bare Metal Apps	**494,209**	**437,136**	**435,356**	**424,321**	**383,013**	**357,202**	**426,512**	**0%**
Total # of Enterprise Logical Bare Metal Apps	**4,627,778**	**3,530,742**	**3,097,920**	**2,645,064**	**2,163,306**	**1,863,917**	**2,064,459**	**-10%**
YoY DSP Bare Metal Applications	*1%*	*-12%*	*0%*	*-3%*	*-10%*	*-7%*	*19%*	
YoY Enterprise Bare Metal Applications	*-11%*	*-24%*	*-12%*	*-15%*	*-18%*	*-14%*	*11%*	
% of Total Bare Metal Logical applications (DSP)	*9.6%*	*11.0%*	*12.3%*	*13.8%*	*15.0%*	*16.1%*	*17.1%*	
% of Total Bare Metal Logical applications (Enterprise)	*90.4%*	*89.0%*	*87.7%*	*86.2%*	*85.0%*	*83.9%*	*82.9%*	

Source: Morgan Stanley Research estimates, IDC

Morgan Stanley

Part III: Server Workload Model

Logical Application Forecast: Enterprise VM-based Apps CAGR of ~8%

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Logical Applications Forecast (Traditional + Cloud Native)								
Forecast: Apps Running in Virtual Machines								
# of Workloads per VM	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
# of VMs Not Running Containers	248,516,297	291,437,506	329,565,936	354,700,826	376,143,416	401,738,197	423,441,620	8%
# of Workloads Running in VMs	248,516,297	291,437,506	329,565,936	354,700,826	376,143,416	401,738,197	423,441,620	8%
YoY	*13%*	*17%*	*13%*	*8%*	*6%*	*7%*	*5%*	
# of VM Workloads per Logical App	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Total # of Logical Apps Running in VMs	**82,838,766**	**97,145,835**	**109,855,312**	**118,233,609**	**125,381,139**	**133,912,732**	**141,147,207**	8%
YoY	*13%*	*17%*	*13%*	*8%*	*6%*	*7%*	*5%*	
% of total Logical applications	71.2%	64.9%	55.5%	42.3%	32.8%	27.6%	23.9%	
Breakout of VM: DSP Internal vs. Enterprise								
% DSP Internal VM Workloads	5.0%	5.2%	5.4%	5.6%	5.8%	5.7%	5.6%	
% Enterprise VM Workloads	95.0%	94.8%	94.6%	94.4%	94.2%	94.3%	94.4%	
# of DSP Internal VM Workloads	12,487,800	15,278,283	17,748,991	19,922,247	21,914,698	22,866,058	23,532,373	9%
# of Enterprise VM Workloads	236,028,497	276,159,223	311,816,945	334,778,578	354,228,718	378,872,139	399,909,247	8%
YoY Growth in DSP VM-based Workloads	*18.8%*	*22.3%*	*16.2%*	*12.2%*	*10.0%*	*4.3%*	*2.9%*	
YoY Growth in Ennterprise VM-based Workloads	*13.1%*	*17.0%*	*12.9%*	*7.4%*	*5.8%*	*7.0%*	*5.6%*	
# of VM-based Workloads per Logical App (DSP)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
# of VM-basedl Workloads per Logical App (Enterprise)	2.9	2.9	2.9	2.9	2.9	2.9	2.9	
Total # of Logical VM-based Apps (DSP)	**1,248,780**	**1,527,828**	**1,774,899**	**1,992,225**	**2,191,470**	**2,286,606**	**2,353,237**	9%
Total # of Logical VM-based Apps (Enterprise)	**81,589,986**	**95,618,007**	**108,080,413**	**116,241,384**	**123,189,669**	**131,626,127**	**138,793,969**	8%
YoY VM-based Applications (DSP)	*18.8%*	*22.3%*	*16.2%*	*12.2%*	*10.0%*	*4.3%*	*2.9%*	
YoY VM-based Applications (Enterprise)	*13.3%*	*17.2%*	*13.0%*	*7.6%*	*6.0%*	*6.8%*	*5.4%*	
% of VM-based Applications (DSP)	*1.5%*	*1.6%*	*1.6%*	*1.7%*	*1.7%*	*1.7%*	*1.7%*	
% of VM-based Applications (DSP)	*98.5%*	*98.4%*	*98.4%*	*98.3%*	*98.3%*	*98.3%*	*98.3%*	

Source: Morgan Stanley Research estimates, IDC

Morgan Stanley

Part III: Server Workload Model

Logical Application Forecast: Total # Apps Broken Down by DSP vs Enterprise

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Forecast: # of Cloud Native Apps								
DSP Internal Cloud Native Apps								
# of Container Instances per App (DSP)	2,250	2,250	2,250	2,250	2,250	2,250	2,250	
# of Container Instances per App (Enterprise)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
# of Container Instances (DSP)	817,115,540	1,104,788,813	1,455,703,892	1,867,458,059	2,366,874,478	2,899,094,800	3,321,679,716	25%
# of Container Instances (Enterprsie)	196,343,976	336,422,701	587,238,464	1,100,777,234	1,769,136,192	2,429,653,505	3,113,792,209	56%
# of Cloud-native Apps (DSP)	**363,162**	**491,017**	**646,980**	**829,981**	**1,051,944**	**1,288,487**	**1,476,302**	**25%**
# of Cloud-native Apps (Enterprise)	**28,049,139**	**48,060,386**	**83,891,209**	**157,253,891**	**252,733,742**	**347,093,358**	**444,827,458**	**56%**
Total # of Cloud-native Apps	**28,412,302**	**48,551,403**	**84,538,189**	**158,083,872**	**253,785,686**	**348,381,844**	**446,303,761**	**56%**
YoY	144.0%	70.9%	74.1%	87.0%	60.5%	37.3%	28.1%	
% of total Logical applications	24.4%	32.4%	42.7%	56.6%	66.5%	71.9%	75.7%	
Total # of Logical Apps	**116,373,055**	**149,665,116**	**197,926,777**	**279,386,865**	**381,713,143**	**484,515,696**	**589,941,938**	**32%**
YoY	28.7%	28.6%	32.2%	41.2%	36.6%	26.9%	21.8%	
Total # of DSP Internal Apps	**2,106,152**	**2,455,981**	**2,857,235**	**3,246,527**	**3,626,427**	**3,932,294**	**4,256,051**	**12%**
YoY	17.0%	16.6%	16.3%	13.6%	11.7%	8.4%	8.2%	
% of total applications	1.8%	1.6%	1.4%	1.2%	1.0%	0.8%	0.7%	
Total # of Enterprise Apps	**114,266,903**	**147,209,135**	**195,069,542**	**276,140,338**	**378,086,716**	**480,583,402**	**585,685,887**	**32%**
YoY	28.9%	28.8%	32.5%	41.6%	36.9%	27.1%	21.9%	
% of total applications	98.2%	98.4%	98.6%	98.8%	99.0%	99.2%	99.3%	

Source: Morgan Stanley Research estimates, IDC

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Part III: Server Workload Model

Logical Application Forecast: Public Cloud vs. On-Premise

MS Global Enterprise Workload Model	2020	2021	2022E	2023E	2024E	2025E	2026E	'21 - '26 CAGR
Enterprise Apps: Cloud vs. On-Premise Forecast								
Forecast: Enterprise Public Cloud Apps								
Public Cloud Servers	9,175,855	11,232,994	13,273,026	15,552,915	18,034,209	20,519,266	22,664,935	**15%**
YoY	18%	22%	18%	17%	16%	14%	10%	
Total # of Enterprise Apps	114,266,903	147,209,135	195,069,542	276,140,338	378,086,716	480,583,402	585,685,887	**32%**
Cloud Native	28,049,139	48,060,386	83,891,209	157,253,891	252,733,742	347,093,358	444,827,458	**56%**
Public Cloud	16,334,495	29,799,402	53,866,596	105,193,186	168,545,668	228,751,268	289,979,896	**58%**
On-premise	11,714,644	18,260,984	30,024,613	52,060,705	84,188,074	118,342,090	154,847,562	**53%**
Traditional	86,217,764	99,148,749	111,178,333	118,886,447	125,352,975	133,490,044	140,858,428	**7%**
Public Cloud	18,536,530	25,949,588	31,133,854	35,937,409	40,730,881	46,377,662	51,815,782	**15%**
On-premise	67,681,233.88	73,199,161.01	80,044,478.89	82,949,038.42	84,622,093.75	87,112,381.92	89,042,646.37	**4%**
Bare Metal	*4,627,778*	*3,530,742*	*3,097,920*	*2,645,064*	*2,163,306*	*1,863,917*	*2,064,459*	**-10%**
Public Cloud	720,288	549,121	526,471	491,639	436,088	395,354	440,236	**-4%**
On-premise	*3,907,490*	*2,981,621*	*2,571,449*	*2,153,425*	*1,727,218*	*1,468,563*	*1,624,223*	**-11%**
VM-based	*81,589,986*	*95,618,007*	*108,080,413*	*116,241,384*	*123,189,669*	*131,626,127*	*138,793,969*	**8%**
Public Cloud	17,816,242	25,400,467	30,607,383	35,445,770	40,294,793	45,982,308	51,375,546	**15%**
On-premise	63,773,743.60	70,217,540.04	77,473,029.87	80,795,613.79	82,894,875.70	85,643,818.50	87,418,423.30	**4%**
Enterprise Public Cloud Apps	**34,871,025**	**55,748,990**	**85,000,450**	**141,130,595**	**209,276,549**	**275,128,930**	**341,795,678**	**44%**
YoY	*70%*	*60%*	*52%*	*66%*	*48%*	*31%*	*24%*	
% of Total Enterprise Apps	*31%*	*38%*	*44%*	*51%*	*55%*	*57%*	*58%*	
% of Total Total Logical Apps	*30%*	*37%*	*43%*	*51%*	*55%*	*57%*	*58%*	

Source: Morgan Stanley Research estimates, IDC

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Appendix

Details on Methodology

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Appendix: Details on Methodology

What Is the Morgan Stanley Enterprise Workload Model?

First Introduced in June 2019 in our North American Insights piece: Software: A New Software Stack for the Digital Era (4 Jun 2019), our proprietary Enterprise Workload & Container Instance model attempts to estimate the # of virtual machine / bare metal workloads as well as the # of container instances and forecast growth in these dimensions over time.

Why Did We Build This?

Adoption of new application architectures is accelerating the deployment of applications and digital services, which along with increasing public cloud adoption represent the key forces that fuel spend on New Stack software.

Furthermore, we believe a bottom-up approach can be useful in helping size difficult-to-estimate various product markets. For example, we will use the output of our updated Enterprise Workload & Container Instance Model to drive our estimate for the total number of enterprise applications. Similarly, the model can be used as another tool to size distinct product markets such as observability, operational database, and cloud security.

How Is the Model Built?

The logic of the model centers from two core concepts: 1) the growth in the physical servers' installed base; and 2) the efficiency of utilization of sever capacity that is made possible by improvements in virtualization and containerization.

- We track / forecast the physical server installed base globally
- We estimate the % of the physical server installed base that is virtualized
- We estimate the # of virtual machines (VMs) that run on virtualized servers on average – VM density ratio
- We estimate the % of hosts (VMs or bare metal/physical servers) that are running containers
- We estimate the # containers running on a host on average
- We estimate the % of containers running inside virtual machines or on bare metal servers
- From the above, we arrive at an estimate of the # of total workloads and container instances
- Lastly, we estimate the total # of applications supported by our workload and container instance estimate

Source: Morgan Stanley Research, IDC

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Appendix: Details on Methodology

Key Definitions and Terms for the Analysis

Cloud-native: An application architecture for building modern applications and digital services using modern tools and approaches such as microservices, containers, Kubernetes and serverless. For the purpose of this exercise, cloud-native applications are all applications built on containers instances.

Traditional applications: An application not built on containers, but instead applications build on top of virtual machines or bare metal servers.

Workload: Represents a unit of work performed by a container instance (or cluster of containers) or virtual machine or a physical server.

Logical Application: A collection of workloads that together solves a specific business purpose or automates a business process.

Bare-metal Server: A physical server that has not been virtualized. In this analysis we assume one bare metal server runs a single workload.

Virtual machine: A virtual environment with its own unique operating system that runs on a servers that have been virtualized. Today, a virtualized server can run multiple virtual machines (usually 10+).

Host: For the purpose of this analysis, a host is either: 1) a physical server, or 2) a Virtual Machine (VM), running on-premise or in the public cloud

Digital Service Provider (DSP): Include public cloud providers, large internet hyper-scalers and large telecom providers. For this analysis, DSP infrastructure (servers, hosts, containers) support the internal applications of the digital service provider. Example: Gmail, Facebook Messenger.

Source: Morgan Stanley Research

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We would appreciate any feedback on how to further improve our methodology

Sanjit Singh
sanjit.singh@morganstanley.com
(415) 576-2060

Keith Weiss
keith.weiss@morganstanley.com
(212) 761-4149

Matt Wilson
matt.wilson@morganstanley.com
(212) 761-7659

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TOTAL	**3,534**		**714**			**1511**	

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INDUSTRY COVERAGE: Software

COMPANY (TICKER)	RATING (AS OF)	PRICE* (10/25/2022)
Elizabeth Porter, CFA		
Amplitude Inc. (AMPL.O)	E (10/25/2021)	$16.05
GoDaddy Inc (GDDY.N)	E (07/19/2021)	$79.65
LegalZoom.com Inc (LZ.O)	U (07/28/2022)	$8.53
Liveramp Holdings Inc (RAMP.N)	O (07/15/2019)	$18.30
Matterport Inc (MTTR.O)	E (04/19/2022)	$3.63
Semrush Holdings Inc -A (SEMR.N)	E (06/06/2022)	$12.05
Sprinklr Inc (CXM.N)	E (07/19/2021)	$9.31
Sprout Social Inc (SPT.O)	E (11/17/2020)	$58.86
UserTesting Inc. (USER.N)	E (10/19/2022)	$3.94
Wix.Com Ltd (WIX.O)	E (05/19/2022)	$85.97
Zendesk, Inc (ZEN.N)	++	$76.35
Zeta Global Holdings Corp (ZETA.N)	E (07/06/2021)	$7.99
ZoomInfo Technologies Inc (ZI.O)	O (11/18/2020)	$46.68

Hamza Fodderwala

Check Point Software Technologies Ltd. (CHKP.O)	U (01/13/2020)	$116.73
CrowdStrike Holdings Inc (CRWD.O)	O (06/06/2022)	$162.11
CyberArk Software Ltd (CYBR.O)	O (10/01/2020)	$156.19
ForgeRock Inc (FORG.N)	E (10/11/2021)	$22.47
Fortinet Inc. (FTNT.O)	O (10/07/2022)	$55.92
KnowBe4 (KNBE.O)	++	$24.52
NortonLifeLock Inc (NLOK.O)	E (03/29/2022)	$22.25
Okta, Inc. (OKTA.O)	E (09/01/2022)	$58.31
Palo Alto Networks Inc (PANW.O)	O (10/10/2017)	$166.19
Qualys Inc (QLYS.O)	U (02/09/2021)	$139.07
Rapid7 Inc (RPD.O)	E (08/11/2015)	$45.03
Secureworks Corp (SCWX.O)	E (09/09/2020)	$8.18
SentinelOne, Inc. (S.N)	O (07/25/2021)	$23.71
Tenable Holdings Inc (TENB.O)	O (01/15/2019)	$34.23
Varonis Systems, Inc. (VRNS.O)	E (06/27/2022)	$27.31
Zscaler Inc (ZS.O)	O (01/18/2022)	$157.09

Josh Baer, CFA

2u Inc (TWOU.O)	E (11/24/2020)	$5.54
Asana Inc (ASAN.N)	E (10/26/2020)	$21.86
Box Inc (BOX.N)	O (10/03/2022)	$28.71
Chegg Inc (CHGG.N)	E (11/02/2021)	$22.19
Coursera, Inc. (COUR.N)	O (04/26/2021)	$12.35
Cvent (CVT.O)	E (06/17/2022)	$5.83
DigitalOcean Holdings Inc (DOCN.N)	U (07/11/2022)	$38.31
Docebo Inc. (DCBO.O)	E (04/26/2022)	$29.58
DocuSign Inc (DOCU.O)	U (10/03/2022)	$50.23
Instructure Holdings Inc (INST.N)	O (12/09/2021)	$24.05
Lightspeed POS Inc. (LSPD.N)	E (02/18/2021)	$18.52
Sabre Corp (SABR.O)	E (03/16/2021)	$5.60
Smartsheet Inc (SMAR.N)	O (05/22/2018)	$34.83
Toast, Inc. (TOST.N)	O (12/16/2021)	$22.22
Udemy Inc (UDMY.O)	E (11/23/2021)	$14.33
WalkMe Ltd (WKME.O)	E (06/07/2022)	$7.90

Keith Weiss, CFA

Adobe Inc. (ADBE.O)	E (06/21/2022)	$323.79
Akamai Technologies, Inc. (AKAM.O)	E (04/29/2020)	$88.45
Atlassian Corporation PLC (TEAM.O)	O (01/13/2020)	$206.04
Autodesk (ADSK.O)	E (08/19/2021)	$215.72
BigCommerce Holdings, Inc. (BIGC.O)	E (05/11/2021)	$14.66
Bill.com Holdings (BILL.N)	O (09/12/2022)	$133.80
Cloudflare Inc (NET.N)	E (06/18/2020)	$57.55
Coupa Software Inc (COUP.O)	O (04/14/2020)	$54.27
Freshworks Inc (FRSH.O)	E (10/18/2021)	$13.84
HubSpot, Inc. (HUBS.N)	O (03/25/2020)	$290.58
Intuit (INTU.O)	O (10/05/2020)	$432.08
Microsoft (MSFT.O)	O (01/13/2016)	$250.66
Oracle Corporation (ORCL.N)	E (01/15/2019)	$73.14
Palantir Technologies Inc. (PLTR.N)	E (03/07/2022)	$8.66
Qualtrics (XM.O)	O (12/16/2021)	$11.38
Salesforce.com (CRM.N)	O (05/19/2021)	$165.27
Samsara Inc (IOT.N)	O (01/10/2022)	$12.31
ServiceNow Inc (NOW.N)	O (11/12/2020)	$376.66
Shopify Inc (SHOP.N)	E (06/24/2022)	$29.83
Snowflake Inc. (SNOW.N)	O (02/07/2022)	$181.82
Splunk Inc (SPLK.O)	E (04/27/2021)	$82.87
UiPath Inc (PATH.N)	E (09/07/2022)	$12.40
Veeva Systems Inc (VEEV.N)	E (12/16/2021)	$166.68
Vertex Inc. (VERX.O)	U (04/07/2021)	$17.20
VMware Inc (VMW.N)	++	$111.42
Workday Inc (WDAY.O)	O (04/14/2020)	$156.18

Meta A Marshall

8x8 Inc (EGHT.N)	E (01/13/2020)	$3.55
Five9 Inc (FIVN.O)	E (10/10/2022)	$59.79
NICE Ltd. (NICE.O)	E (12/16/2021)	$196.18
RingCentral Inc (RNG.N)	E (12/16/2021)	$35.12
Twilio Inc (TWLO.N)	O (09/19/2019)	$76.61
Zoom Video Communications Inc (ZM.O)	E (10/11/2022)	$84.09

Roy D Campbell

Karooooo Ltd (KARO.O)	O (04/27/2021)	$23.79

Sanjit K Singh

Alteryx Inc (AYX.N)	E (04/01/2021)	$48.54
Appian Corp (APPN.O)	E (12/03/2021)	$47.87
C3.ai (AI.N)	U (01/04/2021)	$12.76
Confluent, Inc. (CFLT.O)	E (07/19/2021)	$28.00
Couchbase, Inc. (BASE.O)	E (08/16/2021)	$12.86
Datadog, Inc. (DDOG.O)	O (05/21/2021)	$88.75
Domo Inc (DOMO.O)	O (12/17/2020)	$19.16
Fastly Inc. (FSLY.N)	U (07/11/2022)	$8.77
HashiCorp (HCP.O)	E (01/03/2022)	$33.94
JFrog Ltd. (FROG.O)	E (10/12/2020)	$26.36
MongoDB Inc (MDB.O)	O (12/17/2020)	$200.69
New Relic Inc (NEWR.N)	E (07/11/2022)	$61.06
PagerDuty, Inc. (PD.N)	E (05/06/2019)	$25.25
Solarwinds Corp (SWI.N)	E (11/13/2018)	$9.00
Sumo Logic Inc (SUMO.O)	E (10/12/2020)	$7.46

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* Historical prices are not split adjusted.