

Market Definitions and Methodology: Software

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Initiatives: [Technology Market Essentials](#); [Technology Markets and Companies Insights for Investors](#)

Gartner publishes comprehensive market trends, market share statistics and forecast statistics by major software markets and subsegments. Read this report to gain a better understanding of our terminology and definitions.

Additional Perspectives

- [Update: Gartner to Expand Its Software Market Segmentation](#)
(22 November 2021)

What You Need to Know

Gartner publishes comprehensive market trends, market share statistics and forecast statistics by software market. The foundation for all software research is based on consistent nomenclature and classification. Primary survey data and vendor revenue are captured based on Gartner-defined software market segmentation.

This report is intended to be used in conjunction with Gartner's software research, including market statistics documents (Market Share: All Software Markets, which is updated annually, and forecast statistics documents for enterprise software markets, which are updated quarterly). A description of the methodology used to develop this data is included here.

The purpose of this guide is to enable readers of Gartner's enterprise software research to understand the methodology used to arrive at this forecast and market share.

Any modifications to our Market Share and Forecast segmentation and/or definitions are published as Update notes for the relevant Market Definitions and Methodology documents in the fourth quarter. Typically, these modifications are then applied in quarterly and annual Market Share publications, publishing in the second quarter, and subsequent forecast publications.

Introduction

Gartner defines software as a general term for the various kinds of programs used to operate computers and related devices. Software is divided into:

- Application software (programs that end users work in directly)
- Infrastructure or system software, which allows someone to build, run and manage systems and includes any program that supports application software

Gartner's software research covers key areas of the enterprise application and infrastructure software markets worldwide. Although some of our research encompasses the entire horizontal enterprise software industry, the majority of research is done at the segment level. We break the software industry into logical segments, which enables in-depth and segment-specific research. Gartner's software taxonomy can be found in the High-Level Definitions and Segmentation section of this document. These definitions are revised, altered or expanded each year to reflect changes in software technologies and the software marketplace.

Within each of these segments, research documents produced will include some or all of the following:

- Competitive Landscapes
- Market Impact
- Market Forecasts
- Forecast Analyses
- Market Size and Vendor Market Share
- Market Share Analysis
- Market Trends

■ Survey Analyses

Our research covers software vendors worldwide by selected software categories as defined in the High-Level Definitions and Segmentation section of this document. Based on this research, the Gartner Software team develops, maintains and publishes information on software supply by vendor, revenue, region and software segment. Gartner Software defines a software vendor as a company that provides commercial repeatable software (functionality) to clients either directly or indirectly, via purchasing (software licensing) or rental (cloud hosting, application service provider, subscription or outsourcing).

Notable Changes

Effective April 2021, Gartner has made the following changes to its annual software market share and forecast segmentation:

Analytics and Business Intelligence (ABI) is now renamed as Analytic Platforms. The subsegment names have also changed:

1. Analytic Applications will be renamed ABI Custom Applications.
2. Location Intelligence will be renamed Location Intelligence Platforms.
3. Modern Business Intelligence (BI) Platforms will be renamed Analytics and BI Platforms.
4. Traditional BI Platforms will be renamed Enterprise Reporting Platforms.

Apart from the names, the definitions of the segments and the technologies included in them will not change.

Under application infrastructure and middleware software market:

- We renamed the Message-Oriented Middleware segment to the Event Brokers and Messaging Infrastructure segment. The definition will remain unchanged.
- Introduced a new segment called Event Stream Processing (ESP) Platforms.

CRM is now broken into five submarkets:

- We added a new market — Cross-CRM — at Level 4 (of the taxonomy)

Minor changes are made in naming and splitting out of emerging markets, but some of the subsegment changes (Level 5) will impact the revenue of the Level 4 markets — namely:

- Marketing
 - Revenue for Customer Data Platform (CDP) will be moved to Cross-CRM.
 - Revenue for Voice of the Customer will be moved to Cross-CRM.
- Customer Service and Support
 - Customer Success Management will be moved to Sales.

Content Collaboration Platforms is renamed as Content Collaboration Tools. The definition of this segment has not changed.

New market segment named Data Management Software (Excluding DBMS) is created:

- Changed the market segment name from Data Integration Tools to Data Integration Software and placed it under Data Management Software (Excluding DBMS).
- Changed the market segment name from Data Quality Tools to Data Quality Software and placed it under Data Management Software (Excluding DBMS).
- Changed the market segment name from Master Data Management Products to Master Data Management Software and placed it under Data Management Software (Excluding DBMS).
- Created a new market segment called Metadata Management Software and placed it under Data Management Software (Excluding DBMS), which will result in some effect on revenue allocations for a few larger multimarket vendors that will be included in this subsegment.

This effectively means that Data Management Software (Excluding DBMS) would include the original Data Integration Tools, Data Quality Tools and Master Data Management Products markets and the new Metadata Management Software market, while DBMS continues to be a separate market.

Storage Management Software is now renamed to Storage Software. In addition:

- We collapsed the Backup and Recovery Software and Data Replication subsegments to create a new subsegment called Backup and Recovery Software.
- Collapsed the Infrastructure Software-Defined Storage and Management Software-Defined Storage subsegments to create a new subsegment called Software-Defined Storage.
- Collapsed the Other Storage Management Software, Storage Management Mainframe Software and File Analysis Software subsegments to create a new subsegment called Other Storage Software.

Gartner updated the constant currency regime to a new base year of 2020. Data reported in constant currency now uses the 2020 U.S. dollar exchange rates as the base value (2020 as base year) to convert other currencies, instead of the 2013 exchange rates as the base value (2013 as base year) used in previous iterations.

The change of base year will better present the overall market growth opportunity by eliminating the effect from historic exchange rate fluctuations between the U.S. dollar and other currencies. This will impact the data level in constant currency for many countries when compared with prior publications. Spending/revenue in constant currency now will be closer to the data in U.S. dollars. This can result in changes in growth rates at higher levels of aggregation, such as regional or worldwide totals. The change of base year causes the relative-weight changes for individual countries within the regional aggregate.

Gartner also updated the currency basket for Rest of Middle East and North Africa and Rest of Sub-Saharan Africa. Their values are revised to link with only the U.S. dollar instead of both the U.S. dollar and euro.

For the current currency regime that reports data in U.S. dollars, the same methodology is used as before. Gartner exchange rates are updated each quarter and correspond with the publishing cycle of Market Share, Forecast and Forecast Analysis documents.

Methodology

Forecast Methodology

Forecasting provides a structured setting in which to clarify assumptions about the future, helping reduce business risk by aiding executives in planning a strategy and tactics based on likely events and trends. Our objective is to provide clients with forecasts that are useful, credible and as accurate as possible.

Fundamental to the way Gartner conducts its research is an underlying philosophy that the best data and analysis come from a well-balanced methodology. This methodology includes the following:

- Balance between primary and secondary collection techniques
- Balance between supply-side and demand-side analysis
- Balance between the perspectives of experienced industry professionals and rigorous, disciplined techniques of seasoned market researchers

Total Software Revenue

To produce the software Market Share reports, Gartner collects estimates and classifies IT vendors' total software revenue,

Professional services, training, certification, consulting and hardware revenues are not included in total software revenue. (Note: Other IT services revenue, such as consulting, system integration and IT outsourcing, is analyzed in Gartner's IT services research. For more information about the Gartner IT services methodology, see [Market Definitions and Methodology: IT Services](#).)

Tracking total software revenue allows us to capture the impact of increasingly popular software business and consumption models, such as subscription (notably cloud and commercial open-source software).

Understanding Components of Recognized Revenue

Most software companies have the following main components of revenue:

1. Perpetual license (may include upgrades)
2. Software support (maintenance)
3. Subscription (excluding cloud)

4. Cloud subscription

Licenses (Including Upgrades)

Types of licenses include the following (also see Table 1):

- **Perpetual license** — With a perpetual license, customers pay an initial upfront fee for the new license, and they have the right to use that software in perpetuity. However, this does not give customers the right to update to new functionality, new versions or technical support without an additional fee. For that, they must sign an update or maintenance contract (or buy the update one-off, if available that way). This type of license makes up the majority of software licenses sold.
- **Term license** — A term license is when customers pay the initial fee for the new license, they have the right to use that software for a contractually established term. The fee is paid in a lump sum upfront or over a certain period. Once that term is over, customers must again pay for a new term license. Prices probably will have changed since the initial purchase because of the availability of newer versions or price degradation. Customers also generally have a maintenance contract of the same duration as the term license contract. Gartner always clarifies in the vendor interview process whether updates are included directly in the term license. (If they are, this vendor is actually using a subscription license model as defined by Gartner.) True term license revenue (not including updates) is counted by Gartner as new license revenue. (Some vendors call their term licenses “lease licenses” or “rental licenses.”)
- **Appliance** — An appliance is a preconfigured bundle of hardware and software integrated at the factory, created for a specific purpose, and typically packaged with services at the time of sale.
- **Open source** — An open-source license is a type of license that allows the source code, blueprint or design to be used, modified and/or shared under defined terms and conditions. This allows end users and commercial companies to use and modify the source code for their own needs. Open-source licensed software is mostly available free of charge, although this does not necessarily have to be the case. Licenses that permit only noncommercial redistribution or modification of the source code for personal use only are generally not considered open-source licenses.

Table 1: License-Type Matrix

	Length of Term	Includes Updates
Perpetual	Forever	No
Term	Term	No
Appliance	Forever	Varies
Open Source	Forever	Varies
<p>Note: If the vendor's licensing model, managerial accounting and investor reporting practices do not match up to Gartner's definitions, then additional adjustments may need to be made to estimate the software and hardware revenue according to those definitions. To better serve clients, Gartner is constantly seeking to provide the best and most current software industry analysis possible. As vendors modify and evolve licensing and pricing models to achieve a competitive edge, Gartner reviews and revises its models and rules to keep up with industry practices.</p>		

Source: Gartner (June 2021)

Software Support (Maintenance)

This comprises revenue generated from providing software support services and updates. This mainly comprises maintenance software revenue resulting from work such as bug fixes, as well as technical support fees.

Subscription (Excluding Cloud)

A subscription license is when the customer pays the initial fee and signs the contract for the new license, they have the right to use the software developed by the vendor for a contractually specified time. This is similar to a term license. However, unlike the term license, customers also have the right to subsequent updated versions of the software, as well as a certain amount of technical support.

Table 2: Description of Subscription (Excluding Cloud)

	Length of Term	Includes Updates
Subscription	Term	Yes

Source: Gartner (June 2021)

Cloud Subscription

The customer buys and runs the subscription in-house or in a public or private cloud environment of the customer’s choice. It provides the flexibility to run the software wherever the customer chooses.

Alternatively, the customer buys the subscription (commonly referred to as SaaS or platform as a service [PaaS]) that is hosted by the same software vendor, either in a private or public cloud. In the SaaS or PaaS model, the software company generally makes no tangible software product available to its users, and the product itself is available only as a hosted platform by the software vendor.

Market Share and Market Sizing Methodology

Annually, Gartner analysts review the lists of vendors and the segments that will be researched. This review allows for vendors to be added or removed, and for any adjustments that need to be made for new entrants, mergers and acquisitions, and regional expansion. The same is true for product categories as emerging segments are added or outdated segments are removed from the research agenda.

Gartner’s vendor market share methodology combines publicly available information, primary and secondary research sources, and data unique to Gartner as the quantitative foundation of software market statistics reports. In addition, tracked vendors are surveyed and interviewed by Gartner analysts in the following regions – Asia/Pacific, Europe, Japan, Latin America, the Middle East and Africa, and North America (the U.S. and Canada). Market share is further informed by Gartner’s established, extensive statistics on current and past computing and telecommunications spending, research on IT metrics, end-user survey data, Gartner.com search analytics, and local analyst expertise.

Other sources of data used by Gartner include but are not limited to:

- The more than 100,000 end-user inquiries that Gartner receives each year

- Interviews with the channel, including manufacturers, distributors and resellers
- Information published by major industry participants
- Estimates made by reliable industry spokespersons
- Government or trade association data
- Published product literature and price lists
- Relevant economic data
- Articles in the general and trade press
- Published company financial reports
- Reports from financial analysts
- Information and data from online data banks and content aggregators
- Demand-side (end-user) surveys

Particularly significant sources of information are those published by vendors to the U.S. Securities and Exchange Commission (SEC) and to similar non-U.S. government agencies. The data is used by Gartner to prevent “double counting” revenue in more than one segment. Information filed with government agencies is used to cross-reference analyst estimates, and is the final check as separate segment and market estimates are rolled up.

Gartner undertakes defined processes to ensure its market share data is as accurate and meaningful as possible. However, careful attention must be paid to market definitions as companies, government agencies and trade associations may use slightly different definitions of product categories and regional groupings, or they may include different business entities in their summaries. These differences should be kept in mind when making comparisons between data provided by Gartner and data provided by other research organizations or by the vendors themselves. In Gartner’s research, vendor revenue reflects Gartner’s estimates in all cases.

Vendor

A vendor is a trading entity that sells a finished product directly to end users or through a channel. A vendor may design and manufacture its own products, assemble complete systems from components produced by others, or procure products from an original equipment or contract manufacturer. A vendor may also provide services, maintenance or nonmaintenance for its own products or for other vendors' products and may also provide services for IT technologies.

Vendor Revenue Profile

Gartner creates and maintains a high-level company model called a Vendor Revenue Profile (VRP) for each of the vendors it covers. Gartner Vendor Revenue Profiles represent Gartner's interpretation of a vendor's revenue mapped to Gartner's technology segmentation. The Vendor Revenue Profile provides a calendar-year view of a vendor's merchant sales (that is, sales to external customers) across IT market segments. When analyzing the financial data of a vendor that does not end its fiscal year on 31 December, Gartner "calendarizes" that vendor's financial earnings by adjusting the vendor's fiscal year to align with the calendar year. If a vendor's fiscal quarter breaks across a calendar quarter, Gartner splits the quarters into months and recalculates estimates for calendar quarters and years accordingly. We assume equal distribution of revenue across the three quarters.

Technology segments featured in a Vendor Revenue Profile are nonoverlapping, and they are reconciled with the consolidated view of the vendor's public financial statements when available. These models are created and maintained for all vendors, large or small, public or private.

Vendor Revenue Profiles divide a vendor's revenue by technology segment, such as IT services, data center systems or software. To create the Gartner software Market Share report, a vendor's software revenue estimate from the Vendor Revenue Profile is further broken down to the product or application level in collaboration with multiple software product or market analysts.

Creating and maintaining a single-company model across software ensures that no double counting of revenue occurs for stand-alone software market segments. All analysts' detailed estimates of product, service, maintenance and other revenue must add up to the same revenue number that the vendor files with the SEC or non-U.S. government agencies, or with the high-level revenue model established for privately owned vendors.

For more information on Vendor Revenue Profiles, see [Understanding the Gartner Vendor Revenue Profile](#).

Accounting Standards and Revenue Recognition

Compared to 10 years ago, today's software vendors offer a much wider variety of contract terms and conditions, as well as pricing, billing and payment models. Sometimes, it is the customer that is demanding variations from a "standard" contract. Other times, it is the vendor that is adjusting the terms and conditions to make the customer "sticky" (less likely to switch suppliers) or to smooth the vendor's revenue recognition on its income statement.

Gartner anchors its published vendor market revenue estimates for publicly traded companies to the revenue numbers reported in the vendor's SEC filings or the international equivalent. We assume that the vendors are following generally accepted accounting principles (GAAP) and Financial Accounting Standards Board (FASB) or International Financial Reporting Standards (IFRS) guidelines for how and when to recognize software contract revenue.

In accordance with these guidelines, if a software vendor contract contains contingencies, all or part of the revenue must be deferred until the contingencies are removed and "delivery" is thereby completed. As a result of this revenue deferral, in any particular quarter, a software vendor's revenue will be made up of revenue not only from current-quarter sales closing activity, but also from billing previous quarters' activity. For example, the value of a newly closed maintenance contract is always posted as a liability to the balance sheet and only later recognized as revenue on the income statement. Depending on the terms and conditions of a particular contract, software license revenue might be recognized over many quarters as well, rather than in the quarter the sales activity was closed. Some types of software license contracts may result in gradual recognition of software license revenue by the vendor rather than a big lump in a single quarter. These are popularly called term, lease, rental or subscription (including SaaS and platform as a service [PaaS]) licenses.

Abstract Components Versus Real-World Complexity

The SEC and the International Accounting Standards Board have a lot to say about when elements of contracts for software products and service revenue can or must be recognized on the income statement as revenue. However, these regulatory bodies do not require that public companies decompose revenue into product or brand line items, such as license, maintenance or consulting.

Software vendors that choose to decompose their revenue for public reporting purposes do not use consistent terminology among themselves. Terms such as “product,” “license,” “new license,” “update license,” “maintenance,” “technical support” and “services” are used differently by different vendors in publicly filed reports. Regulatory authorities do not dictate what words such as “license,” “maintenance,” “updates” and “support” mean in a public report. In fact, these words are used at the vendor’s discretion. Practice varies widely as the vendor decides how to describe its business to its investor community and how much it wants to disclose without giving competitors an edge.

As a result, Gartner analysts carefully analyze and review software vendor public statements and filings to understand and rationalize the different usage of terminology and reporting practices between vendors.

Handling Mergers and Acquisitions

Gartner’s software methodology states that, when a merger or acquisition occurs, historical market share data will remain unchanged. Revenue for the merged or acquired entities will be attributed to the new merged entity or acquiring company only from the quarter in which the merger or acquisition closes.

Forecast Methodology

Forecast statistics are published on a quarterly basis and they consist of two elements:

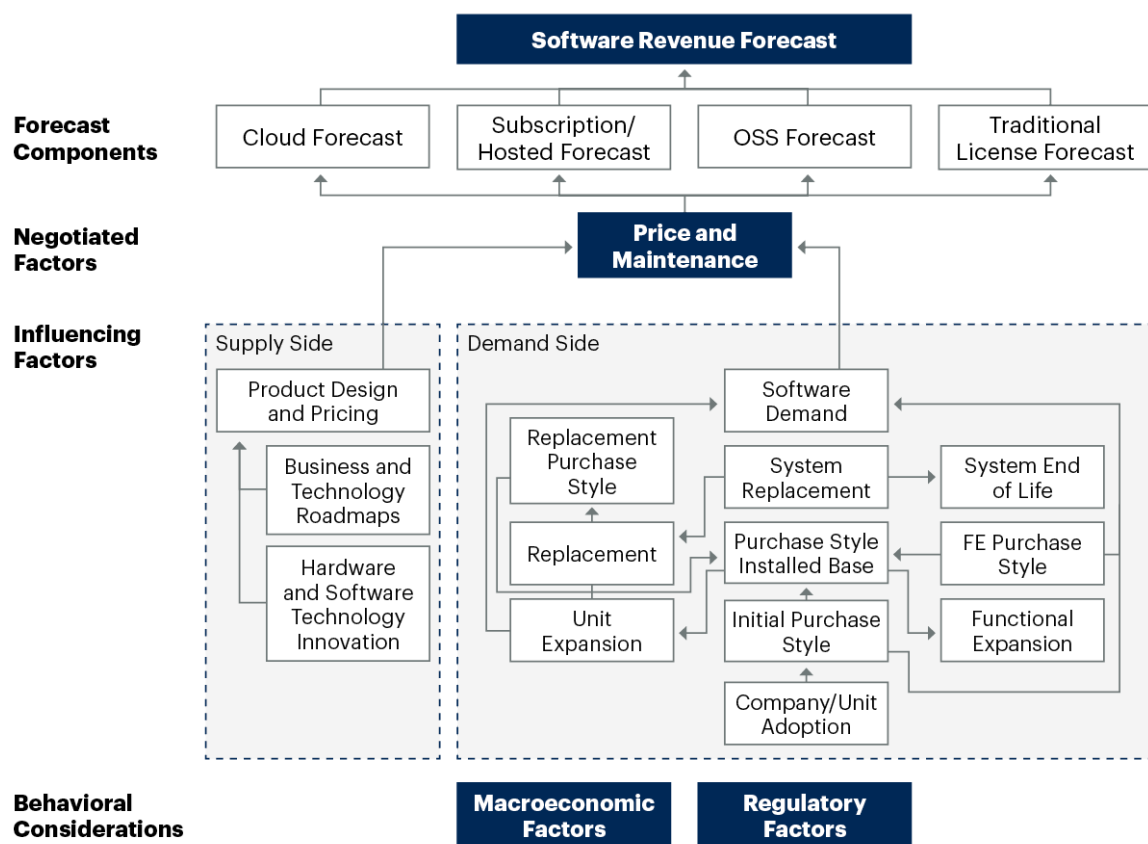
1. Forecast data
2. Supporting assumptions and analysis

Gartner’s forecast methodology for software is based on a market model (see Figure 1), which incorporates all the factors important in describing the structure and dynamics of a market. A market model depicts how we represent a market for forecast purposes. It is presented as a diagram and is designed to convey the methodology employed in creating the forecast. The market model diagram shows a tree of logical dependencies (influencing factors) that the forecast is based on. It incorporates our interpretation of market structure and market dynamics by identifying the component parts of the forecast, identifying the factors that influence the forecast, and describing the relationship between the factors and how those factors affect the forecast components.

Influencing factors are inputs, which, when applied to forecast components, shape the forecast output. That is, influencing factors have an identifiable and measurable effect on the forecast. Influencing factors are features of the market that affect the forecast when they change. These influencing factors are defined by the market dynamics specific to a particular market. Changes in an influencing factor will affect other influencing factors, via a logical connection, and ultimately cause a change in the components of the forecast and, therefore, the forecast itself.

Figure 1. Forecast Methodology

Forecast Methodology



Source: Gartner

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Forecast Process

Gartner's software forecast is systematically developed by a global team of analysts who form assumptions about future changes in influencing factors, using a proprietary collaborative, real-time forecast system based on a multidimensional data model.

Forecasting assumptions are tested against different points of view. The peer review of assumptions strengthens the resulting forecast, as the results are validated within the context not only of individual market segments, but also for the total market. This process assimilates disparate and aggregate data to support forecast decisions that are scrutinized and vetted in a collaborative effort across Gartner. An integral part of this process involves comparing initial forecasts with related forecasts that either flow into or flow from them. For software, this means carefully examining and taking into account related IT services, hardware and equipment forecasts. It also means that the ranks of those involved in the forecast process extend beyond Gartner's global staff of software analysts.

Our methodology provides an iterative approach to an updated forecast in which successive initial forecasts are reviewed, critiqued and revised by all those involved in the forecast process. Gartner believes that a sound forecasting process incorporates art and science into a logical and coherent series of steps. These steps, if conducted in a rigorous and organized fashion, will ensure forecasting effectiveness, reliability and accuracy, and will prove to be a valuable tool for developing sound market strategies. Gartner uses tools and processes that maximize our ability to share processes and time frames to build a unified, coherent picture of the IT market.

Metrics

This section describes the research metrics that Gartner uses for reporting vendor revenue, market size, market share and forecasts. Not all these metrics are used by every software market or by every software segment. Some may have more of these metrics, and some may have fewer.

Compound Annual Growth Rate

The compound annual growth rate (CAGR) is the annualized average rate of revenue growth between two given years, assuming growth takes place at an exponentially compounded rate. The CAGR between given Years X and Z, where $Z - X = N$, the number of years between the two given years, is calculated as follows:

$$\text{Compound Annual Growth Rate, Year X to Year Z} = \left[\left(\frac{\text{value in Year Z}}{\text{value in Year X}} \right)^{\frac{1}{N}} - 1 \right]$$

$$CAGR = \left[\frac{\text{Ending Value}}{\text{Beginning Value}} \right]^{\frac{1}{\text{No. of Years}}} - 1$$

For example, the CAGR for 2019 to 2024 is calculated as:

$$\text{CAGR, 2019 to 2024 (X = 2019, Z = 2024, N = 5)} = [(value\ in\ 2024 / value\ in\ 2019)^{(1 / 5)} - 1]$$

Exchange Rates

Gartner exchange rates are updated quarterly and used for all Market Share, Forecast and Forecast Analysis documents published in the corresponding cycle. Gartner maintains a database of past and future exchange rates, at the quarterly and annual levels. Historical exchange rates are deduced from appropriate averages of monthly exchange rates reported by the U.S. Federal Reserve (the Fed) and the Pacific Exchange Rate Service. Future rates are applied from exchange rates reported quarterly by our data partner IHS Markit, reviewed by Gartner expertise.

For Market Share reports, historical quarterly and annual exchange rates are applied. For Forecast and Forecast Analysis reports, annual exchange rates combining historical and future periods are applied. Gartner's Market Share and Forecast publications always include the exchange rates associated with the published data.

Current- and Constant-Dollar Reporting

Gartner publishes Forecast and Market Share reports that ultimately serve two purposes — gauge the growth opportunity available to vendors/providers and assess market growth. We recognize that the two goals generally cannot be accomplished in one single measure. This is because the revenue growth opportunity available to vendors/providers depends not only on the underlying rate of market growth, but also on the exchange rate at which they can translate monies earned back into their native currency. Thus, significant differences can emerge between vendor/provider revenue growth opportunity and underlying market growth when exchange rates move. Even more to the point, vendor revenue growth opportunity can vary dramatically relative to underlying market growth when exchange rates are volatile. This can cause significant confusion about how fast markets are growing as opposed to how vendors can monetize that growth in dollars, euros or yen as exchange rates change.

To illuminate this point, Gartner reports its forecast and market share data in two ways — in “current” dollars and in “constant” dollars.

- Current-dollar figures indicate the end-user spending in U.S. dollars that vendors/providers could expect to earn, given the prevailing exchange rates.

- Constant-dollar figures, also marked in constant currency, reflect the equivalent U.S. dollar value of market spending translated by fixed time (base year) exchange rates.

Constant Currency Calculation

Gartner develops market shares and forecasts for individual countries in the relevant local currency; that is, U.S. data is developed in U.S. dollars, eurozone data in euros, and so on. Data developed in currencies other than the U.S. dollar is subsequently converted to current U.S. dollars using actual historical and/or forecast future exchange rates.

Constant currency is a commonly used economic construct that is calculated by translating other currencies into dollars using a set of fixed exchange rates versus the U.S. dollars from a given period. This period is called the “base period,” and it is always indicated whenever constant-dollar data is reported — for example, “constant currency (2020 base).”

Precisely because values in constant currency are calculated using exchange rates of a fixed time, they are not affected by exchange rate fluctuations when data originally formulated in other currencies is translated into them. By the same token, growth rates based on constant dollars will reflect only changes in natively valued market shares and forecasts.

(Note: In some contexts, constant currency will imply the figures have been discounted for inflation; this is not the case here. Gartner reports data in both U.S. dollars and constant currency, which implicitly includes inflation, and neither figure has been adjusted for it.)

High-Level Definitions and Segmentation

Enterprise Application Software Definitions

The focus for application software is to increase the performance of business or personal resources. It enables users to leverage the power of computers toward achievement of their business, professional or personal objectives or goals.

Analytic Platforms

Market Analysts: Alys Woodward, Jim Hare, Eric Hunter and Kevin Quinn

See Table 3 for an overview.

Table 3: Analytics Platforms Market Overview

Analytic Platforms				
Business Intelligence (BI) Platforms	AI and Data Science Platforms	Location Intelligence Platforms	ABI Custom Applications	Other Analytic Platforms Software
<div><div></div>Analytics and BI Platforms</div> <div><div></div>Enterprise Reporting Platforms</div>				

Source: Gartner (June 2021)

Notes for Table 3: ABI = analytics and business intelligence; AI = artificial intelligence; BI = business intelligence

“Analytic Platforms” is an umbrella term that includes the applications, tools and best practices that enable access to and analysis of information to improve and optimize decisions and performance.

BI Platforms

BI platforms provide the infrastructure and tools to enable users to build applications that facilitate decision making and help organizations learn, understand and improve their business. Gartner defines a BI platform as a software platform that delivers more than one-third of the following capabilities under three overarching categories of functionality: information delivery, analysis and integration. These categories are discussed fully within the following sections. In 2016, Gartner updated its definition of BI platforms to distinguish between two types: analytics and BI platforms and enterprise reporting platforms.

Analytics and BI Platforms

Analytics and BI platforms support a decentralized and bimodal governed data discovery approach to BI. This serves to meet the increasing demands from business users and analysts for access to self-service capabilities, instead of depending on specialized competency centers and/or IT teams to provide access to analysis. These self-service capabilities include visual data discovery, augmented data discovery, search-based data discovery and data preparation capabilities so users can integrate their own data sources without being restricted to or having to wait for IT-curated data sources. Analytics and BI platforms support greater agility and flexibility, and they are lighter on control and governance than enterprise reporting platforms.

Analytics and BI platforms can be deployed to support use cases that we classify as:

- Visual self-service analytics
- Enterprise analytics
- General analytics
- Embedded analytics
- Augmented analytics

Vendor offerings typically support more than one specific use case — with customers creating hybrid variations as well to support the demands of their organization. For additional information regarding these use cases and platform capability alignment to each, see [Critical Capabilities for Analytics and Business Intelligence Platforms](#).

Critical to the success of BI is for BI platforms to connect to a range of data sources. Analytics and BI platforms have capabilities that allow users to connect to structured and unstructured data contained within various types of storage and data management platforms, both on-premises and cloud-based. Typically, this includes relational and nonrelational (NoSQL) databases, object storage, Apache Hadoop, Apache Spark, and streaming sources, as well as spreadsheets, personal data, web data or text data. The platform may also include connectors to specific enterprise applications or APIs, both on-premises and in the cloud.

Interactive visual exploration enables the exploration of data via the manipulation of chart images, with the color, brightness, size, shape and motion of visual objects representing aspects of the dataset being analyzed. This includes an array of visualization options that go beyond those of pie, bar and line charts, including heat and tree maps, geographic maps, scatter plots, and other special-purpose visuals. These tools enable users to analyze the data by interacting directly with a visual representation of it.

Mobile exploration and authoring are typically provided. This enables organizations to develop and deliver content to mobile devices in a publishing and/or interactive mode. It takes advantage of mobile devices' native capabilities, such as touchscreen, camera, location awareness, and natural language query (NLQ) and natural language processing (NLP).

Some analytics and BI platforms have embedded data science capabilities that are self-contained within the platform itself or through the import and integration of externally developed models, known as "advanced analytics." For security and user administration, analytics and BI platforms include capabilities that enable platform security, administering users, and auditing platform access and utilization.

Enterprise Reporting Platforms

Enterprise reporting platforms are designed to support modular development of IT-produced analytic content and require specialized tools and skills for systems of records. Significant upfront data modeling, coupled with a predefined metadata layer, is required to access their analytic capabilities. These platforms are used primarily for enterprise reporting and dashboards. This contrasts with analytics and BI platforms, which enable nontechnical users to autonomously execute full-spectrum analytic workflows — from data access, ingestion and preparation to interactive analysis and the collaborative sharing of insights.

Enterprise reporting platforms typically have strong functionality in the integration category, particularly specializing in data integration, data modeling and database administration. Each of these areas tends to have different specialists working on them. Therefore, each area requires different tools, so creating analytical solutions in an enterprise reporting platform is dependent on a large amount of coordination of different tools and teams. Enterprise reporting platforms support more centralization, control and governance than analytics and BI platforms, which are focused on giving business users agility and flexibility.

Typically, enterprise reporting platforms include the following capabilities:

- **Reporting** — Provides the ability to create highly formatted, print-ready and interactive reports, with or without parameters.
- **Dashboards** — A style of reporting that graphically depicts performance measures and includes the ability to publish multiobject, linked reports and parameters with intuitive and interactive display. Dashboards often employ visualization components, such as gauges, sliders, check boxes and maps, and are often used to show the actual value of the measure compared with a goal or target value. Dashboards can represent operational or strategic information. A scorecard is a type of dashboard that must follow a management methodology (such as the balanced scorecard or Six Sigma) and must tie operational and strategic key performance indicators (KPIs) represented in a dashboard to a strategy map.
- **Ad hoc report/query** — Enables users to ask their own questions of the data, without relying on IT to create a report. In particular, the tools must have a reusable semantic layer to enable users to navigate available data sources, predefined metrics, hierarchies and so forth.
- **Office suite integration** — Enables integration with Microsoft Office, Google Workspace or similar productivity suites. In particular, Microsoft Office (particularly Excel) sometimes acts as the reporting or analytics client. In these cases, it is vital that the tool provide integration with Microsoft Office (or other productivity suites), including support for native document and presentation formats, formulas, charts, data “refreshes” and pivot tables. Advanced integration includes cell locking and write-back.
- **Mobile BI** — Enables organizations to develop and deliver content to mobile devices in a publishing and/or interactive mode, and it takes advantage of the mobile device’s native capabilities, such as touch, camera, location awareness and NLQ.

AI and Data Science Platforms

Gartner includes revenue from two types of software under AI and data science platforms: that of the core data science platforms themselves, and revenue from cloud-based artificial intelligence (AI) services.

Gartner defines cloud AI developer services (CAIDS) as cloud-hosted or containerized services/models that allow development teams and business users to leverage artificial intelligence (AI) models via APIs, software development kits (SDKs), or applications without requiring deep data science expertise. These hosted models deliver services with capabilities such as:

- **Language capabilities** — Natural language understanding and generation, translation, speech-to-text, and chatbot virtual assistant frameworks
- **Vision capabilities** — Optical character recognition, image recognition and video content analysis
- **Automated machine learning (autoML)** — Automated model-building and data preparation, feature engineering and model management

Gartner defines AI and data science platforms as a core product and supporting portfolio of coherently integrated products, components, libraries and frameworks (including proprietary, partner and open source). Its primary users are data science professionals. These include expert data scientists, citizen data scientists, data engineers and machine learning (ML) engineers/specialists.

Coherent integration means that the core product and supporting portfolio provide a consistent “look and feel” and create a user experience where all components are reasonably interoperable in support of an analytics pipeline.

An AI and data science platform offers a mixture of basic and advanced functionality essential for building predictive and prescriptive models. The platform also supports the incorporation of these solutions into business processes, surrounding infrastructure, products and applications. Additionally, AI is an enabler of key capabilities across platforms spanning nearly all markets (hardware, software and so on). AI and data science platforms focus on capabilities that support the creation of AI and data science models and/or support discrete capabilities via cloud-based AI services noted above.

These platforms support multiple tasks across the AI and data science life cycle, including:

- Problem and business context understanding
- Data ingestion
- Data preparation
- Data exploration
- Feature engineering
- Model creation and training

- Model testing
- Deployment
- Monitoring
- Maintenance
- Data and model governance
- Explainable artificial intelligence (XAI)
- Business value tracking
- Collaboration

Location Intelligence Platforms

Location intelligence platforms are software applications that enable access to and the utilization of geospatial and location data associated with people, objects or landmarks, along with information for location-referenced analysis. There are two major types of location intelligence platforms:

- **Geographic information system (GIS) platforms** used primarily by GIS specialists to capture, store, manipulate, analyze, manage, and present spatial or geographic data. GIS software supports the ability to produce maps and other graphic displays of geographic information for analysis and presentation.
- **General location intelligence (LI) platforms** used by business users to relate geographic and location contexts with other domains of data. They combine interactive maps and spatial data to understand the relationships between certain objects, such as people or static/moving objects, based on their physical locations.

Revenue going into this segment is just for software products designed to import, analyze, render, present, and manage location and spatial information. It does not include revenue for geospatial data management tools, such as those that are part of a larger relational database management system (RDBMS) that can store and manage geospatial data. It also excludes data subscriptions and address standardization and coding accuracy support system (CASS) validation toolsets.

ABI Custom Applications

ABI custom applications are packaged BI capabilities that address a particular domain or industry vertical business problem. Their advantage is that, as packaged solutions, they provide faster deployments and easier maintenance, and they incorporate domain expertise and best practices. Examples of packaging include a UI suitable for casual users, predefined integration with standard business process applications, issue-specific data models, and best-practice templates or wizards.

ABI custom applications are often used to provide support for various aspects of performance management. Corporate performance management (CPM), which was one of the first areas to emerge, is now an established market and hence counted as a separate category. However, other areas of performance management are also supported by ABI custom applications. These ABI custom applications fit into the areas of other finance, sales, marketing, HR, manufacturing, supply chain, procurement, IT, and other horizontal and vertical analytic and performance management applications. Revenue going into this category is for applications that are sold stand-alone (and not embedded as part of a wider enterprise application).

ABI custom applications have the following characteristics:

- **Predefined data integration capabilities** — These enable the application to access and manage data from disparate data sources. The application will have its own extraction, transformation and loading (ETL) tools and may include predefined connectors to specific data sources (such as an ERP system).
- **Predefined data model** — The architecture of any ABI custom applications is defined as a codified set of entities and the relationships between them.
- **Predefined business content** — In simple ABI custom applications, this could be a collection of reports and metrics derived from the predefined ETL and data model. In more-complex ABI custom applications, this will include workflow to support the analytic processes and may extend to complex business functionality to support specific business needs, such as determining customer profitability or performing model-based simulations to evaluate different business strategies.

ABI custom applications support business processes directly; they may support analytical processes, and/or they may use analytical tools and techniques. They cover various functions; some are horizontal in nature, supporting a specific business process (such as sales analytic applications), and some are industry-specific.

Gartner identifies four main classifications of analytical processes in its analytics continuum: descriptive, diagnostic, predictive and prescriptive. **Descriptive analytics** answers the question of what has happened or is happening, while **diagnostic analytics** explains the reason behind what is happening. **Predictive analytics** predicts a likely future scenario, while **prescriptive analytics** offers actionable recommendations for how to manage these scenarios. Revenue going into this category is for cross-industry vertical applications that are sold stand-alone (and not embedded as part of a wider enterprise application).

Other Analytic Platforms Software

This category contains any BI software that does not fit in the categories of BI platforms, AI and Data Science Platforms, LI platforms or ABI custom applications.

Customer Experience and Relationship Management

Market Analysts: Julian Poulter and Yanna Dharmasthira

Customer relationship management (CRM) is a business strategy and technology solution, the outcome of which optimizes lifetime value and the relationship with the customer by:

- Organizing around customer segments
- Generating and nurturing customer engagement behaviors
- Implementing internal and customer-centric processes
- Providing commerce capabilities

Most enterprises have a CRM strategy, and the majority use CRM software to help achieve this strategy. Any CRM implementation will use a variety of CRM software tools and will generally be thought of as a “system of systems.” The CRM software sector, part of the enterprise application software market, provides functionality to enterprises in five markets:

1. Cross-CRM
2. Customer service and support (CSS)
3. Digital commerce

4. Marketing

5. Sales

For an introduction and guide to the breadth of CRM software and Gartner's coverage, see [CRM Application Functionality Taxonomy Propeller](#) and [The Elusive CRM Magic Quadrant](#).

See Table 4 for the CRM 2021 market taxonomy.

Table 4: Customer Relationship Management Market Overview

(Enlarged table in Appendix)

Customer Experience and Relationship Management				
Customer Service and Support	Digital Commerce	Marketing	Sales	Cross-CRM
<ul style="list-style-type: none"> Digital Customer Service Customer Engagement Center CCI and CCaaS Workforce Engagement Management Field Service Management 	<ul style="list-style-type: none"> Digital Commerce Platforms Digital Commerce Ecosystem Applications 	<ul style="list-style-type: none"> Lead Management Account-Based Marketing Multichannel Marketing Digital and Ad-Tech Loyalty Management Web Content Management 	<ul style="list-style-type: none"> Sales Force Automation Sales Acceleration Partner Relationship Management Sales Enablement Configure, Price and Quote Price Optimization Sales Performance Management Recurring Revenue Management Customer Success 	<ul style="list-style-type: none"> Customer Data Platform Voice of the Customer

Source: Gartner (June 2021)

Notes for Table 4: CCaaS = contact center as a service; CCI = contact center infrastructure; CRM = customer relationship management

Cross-CRM

Cross-CRM is a newly defined market in 2020 that covers technologies that operate across the multiple CRM markets of sales, service, commerce and marketing.

Customer Data Platform

A customer data platform is a marketing system that unifies a company's customer data from all parts of a CRM and external systems across channels to enable customers with a 360-degree view, as well as optimize the timing and targeting of messages and offers.

Marketers and other CRM users are using a variety of systems to design, orchestrate and measure multichannel customer engagement. Many of those systems also manage customer-level data and audiences for targeting, but do so in a way that makes orchestrating across channels (and across competitive vendor solutions) a challenge. CDPs promise to solve this by centralizing data collection, unifying customer profiles from disparate sources, creating and managing segments, then activating those segments in priority channels. The CDP is not necessarily a substitute for an enterprise's database of record or master data, but it can effectively ensure that customer profile data, transactional events and analytic attributes are available to CRM and other users when needed for real-time interactions.

The market is composed of a disparate group of vendors that share a vision for helping marketers better activate their first-party data to enable more personalized, real-time marketing. Much of the functionality core to the CDP is not new — data integration, identity management, segmentation and activation are familiar features to marketers. Those features already exist across a variety of tools in their stack. Rather, it is the packaging, marketing and productization of these features, and the optimization for real-time use cases, that compels marketers to investigate how this new technology could produce returns for them.

Voice of the Customer

A comprehensive voice of the customer (VoC) solution integrates feedback collection, analysis, distribution and action into a single interconnected platform, to help you understand and improve customer experience (CX). Feedback sources expand beyond direct surveying to include other, more indirect and inferred feedback sources.

For a solution to be considered a VoC application, it must meet three important criteria:

1. **Channels:** Collect customer feedback through multiple channels, such as email, websites, paper, text messaging, voice, a mobile application, in-app, kiosks and computer-assisted telephone interviewing (CATI).

2. **Data:** Collect and analyze all three types of VoC data:
 - **Direct feedback** — Feedback that consumers intend to provide directly to the organization, when either asked to do so or motivated by their experience. Typically takes the form of a survey, a complaint, market or user research or a forum/panel.
 - **Indirect feedback** — Feedback derived from instances where the customer is speaking about an organization without specifically intending to furnish feedback to the organization. Includes collecting insight from review sites, social networks and customer care interactions via phone, email and chat sessions.
 - **Inferred feedback** — Operational and transactional data associated with a CX or customer journey, such as a website's clickstream data, commerce purchase history, mobile app location data or contact center operational data.
3. **Insight:** Provide tools that convert customer feedback into actionable insight, such as dashboards, alerts, customer journey maps, workflow for service recovery and capabilities to predict and prescribe relevant actions.

See [Market Guide for Voice-of-the-Customer Applications](#).

Customer Service and Support

Customer service and support organizations must deliver consistent, effortless, intelligent and personalized customer service to their customers. The four pillars of great customer service are:

1. Getting connected
2. Process orchestration
3. Resource management
4. Analytics and insights

These four pillars have represented discrete areas of investment, and there has been limited alignment between them. In order to deliver optimized, more intelligent, consistent, personalized and effortless customer service experiences, alignment is necessary.

These four pillars have traditionally been viewed as discrete investments by different business owners and stakeholders leveraging different budgets. Although a unified customer service and support (CSS) suite spanning these domains does not yet exist, there is inherent value in their alignment, and the market is shifting in this direction through R&D/technology acquisition and the creation of multivendor ecosystems.

Digital Customer Service — Orchestration

Gartner defines the digital customer service market as consisting of software applications that enable customer service and support to engage customers through their preferred digital communication channels, allowing for the management of persistent dialogues and communications.

A digital customer service solution is built around conversation orchestration and the availability of continuous intelligence. Continuous intelligence is used to enrich customer service interactions within the solution itself or through integration with other systems (such as CRM customer engagement center [CEC], business process management [BPM] and ERP).

Vendors in this market come from various technology origins. They have evolved to support an increasingly diverse set of digital customer interaction types — such as chat, chatbots, messaging, social media and outbound alerts (or push notifications).

Customer Engagement Center — Orchestration

The orchestration of intelligent customer service processes through a CEC application is built around a case management record and process. It may include advisory services, problem diagnostics and problem resolution, account management, insurance claims handling, servicing of banking interactions, provisioning and returns management, among other things. Workflow is an important CEC component, in terms of an organization being able to orchestrate the processing of customer engagements for the best outcomes in an effortless, effective and timely way. Some organizations require intelligent business process management (BPM) capabilities. In addition to case and workflow management, knowledge — and management — of how to enrich and personalize customer engagements is crucial.

The CRM “customer engagement center” (CEC) or “customer engagement hub” refers to applications for case management, trouble ticketing and problem resolution. Functionality includes:

- Knowledge-enabled service resolution

- Industry-specific functionality and workflows
- Social media engagement and community management
- Offer management
- Interaction assistance tools (chatbots)
- Virtual customer assistants (VCAs)
- Mobile support and multimodal capabilities (such as chat within mobile self-service)
- Co-browsing
- Real-time analytics

AI may be integrated into the workflows, such as recommending solutions to agents or autonomous chatbots.

CCI and CCaaS – Getting Connected

The core capability of a contact center as a service (CCaaS) solution is:

Getting connected – Focusing on delivering a channel-agnostic, architected design to create customer service journeys, including intelligent self-service. Services are consumed on a per seat, per concurrent user or transaction basis.

CCaaS solutions are used by customer service and telemarketing centers, employee service and support centers, help desk service centers, and other types of structured communications operations. They are now the go to technology for most organizations looking to procure sub-500 seat contact center environments. They are also starting to be deployed in multithousand seat environments, even though these may comprise multiple smaller entities. This reflects the desire by customer service organizations to consolidate multiple stand-alone environments and move forward with a single, strategic supplier. CCaaS solutions are typically deployed as an integral part of a broader customer service and support technology ecosystem.

The contact center infrastructure (CCI) market covers solutions that include the equipment, software and services that enables customer service organizations to manage multichannel customer interactions holistically (using self-service and assisted-service) from a customer-experience and an employee-engagement perspective. Contact centers require a wide range of functions, architectures, features and services to be effective. The three common major architectural approaches are:

1. Integrated best-of-breed components
2. All-in-one bundled suites
3. Hosted or private-cloud-based solutions, rather than cloud-based

Central to the definition of CCI is that the solutions are dedicated to supporting a single customer or tenant on each instance of the system, even if that customer/tenant supports multiple contact center operations on that dedicated instance. CCI solutions are used by customer service and telemarketing centers, employee service and support centers, help desk service centers, and other types of structured communications operations.

Workforce Engagement Management – Resource Management

Workforce engagement management (WEM) solutions expand on the already mature workforce optimization (WFO) market by also accommodating technologies that help drive employee engagement within the customer engagement center.

The emphasis in this market during the past decade has primarily been to help improve the operational performance of the contact center. Key functional domains facilitate the recording and assessment of employee performance, combined with the ability to forecast and schedule staffing levels to ensure operational service-level targets are met. Its core value proposition arises from the tight integration and workflow across these various functional domains.

This need to be operationally “well run” is still an important consideration and is at the heart of a WEM solution. Yet various key market shifts have occurred since the inception of WFO that now need to be factored in. Each of these factors requires much more emphasis to be placed on the employee.

Key areas of WEM functionality include:

- Recruitment and onboarding

- Evaluation and improvement
- Time management
- Assistance and task management
- Metrics and recognition
- Voice of the employee (VoE)

For more information, see [Magic Quadrant for Workforce Engagement Management](#).

Field Service Management

Field service management (FSM) is a discrete market within the broader customer service and support software market and is used by field service providers (FSPs). They typically dispatch technicians to remote locations to provide installation, repair or maintenance services for equipment or systems. They may manage, maintain and monitor these assets under a predefined service or maintenance contract. FSM applications provide capabilities to:

- **Manage demand:** They handle the receipt of work requests from external sources, such as customers (through multiple channels), Internet of Things (IoT) connections and service-brokering networks. They also import work requests from internal systems such as ticketing, maintenance, repair and operations (MRO), product life cycle management, long-cycle project management and enterprise asset management systems.
- **Plan work:** They offer skills-based workload balancing, forecasting of shift requirements, schedule optimization and routing for short- and long-cycle work requests. They also offer SLAs and cost prioritization, parts demand planning and purchasing, contracted or contingent third-party service provider management, customer approval coordination and GIS-based planning.

- **Inform and enable technicians:** They do this via apps on mobile and wearable devices for GPS tracking, telematics, equipment work history, service collaboration, customer communication, knowledge management integration and work instruction management, inspections, safety forms, parts sourcing and customer quoting. Organizations provide remote expert guidance for technicians and customers in the field through multiexperience service support channels such as remote video and augmented reality (AR)-based communications systems, IoT visualizations and chatbots (see [Transcend Omnichannel Thinking and Embrace Multiexperience for Improved Customer Experience](#)).
- **Debrief work orders:** They enable online or offline mobile collection of time and parts used, tasks completed, updates to equipment records, site evidence, customer recommendations, signoffs, approvals for additional work and satisfaction surveys.
- **Perform analysis and support integration:** They do this using field service performance management reports and dashboards, predictive analytics, alerts and notifications, and APIs.

FSM products operate across multiple communication channels such as websites, supply chain solutions, third-party service-brokering solutions and analytics. FSM applications draw on software in various markets — CRM, ERP, enterprise asset management (EAM), asset performance management, IoT, workforce management, vendor management, product life cycle management and supply chain markets (with specific supply chain examples being transportation management and fleet management).

Digital Commerce

Gartner defines digital commerce as the interaction (buying and selling) among businesses, people and things for products and/or services via digitalization technologies that results in a transaction of value to the customer. Customer value in this sense is based on a customer-selected combination of factors, such as a great experience, low price, timeliness, ease of use and policies.

Segments included are digital commerce platforms and selected digital commerce ecosystem applications.

Digital Commerce Platforms

Digital commerce platforms are the core technology that enables customers to purchase goods and services through an interactive and self-service experience. The platform provides necessary information for customers to make their purchase decisions and uses rules and data to present fully priced orders for payment. The platform must have out-of-the-box (OOB) capability or the APIs to support a self-service, interactive commerce experience that includes storefront, product catalog navigation, product pages, shopping cart, check-out and customer account.

The commerce product must support OOB ability to search for a product, add products to a cart, and fully price an order inclusive of product-level, customer-level, and order-level discounts or promotions. The commerce product must support interoperability with customer, product, content, and order functionality and data via APIs.

For more information on digital commerce platforms, see [Magic Quadrant for Digital Commerce](#).

Digital Commerce Ecosystem Applications

Effective digital commerce involves far more than just the use of a digital commerce platform. Gartner refers to the digital commerce ecosystem as a set of several additional applications that are commonly layered on top of commerce platforms.

Selected digital commerce ecosystem applications that are covered in our Market Share and Forecast reports is commerce search (part of digital commerce enrichment technologies).

Please note that other digital commerce ecosystem applications (such as payment, personalization, marketing and others) are not yet included in the statistics. We will gradually expand our ecosystem application coverage in the future. The complete spectrum of the digital commerce ecosystem applications can be found in [Evolve Digital Commerce Portfolios by Leveraging the Application Ecosystem](#) and for a more detailed overview, [The Gartner Digital Commerce Vendor Guide, 2021](#).

Marketing

Lead Management

Lead management processes take in leads in the form of unqualified contacts and opportunities. The leads originate from a variety of sources, including browser registration pages and campaigns, direct mail campaigns, email marketing, multichannel campaigns, database marketing and third-party leased lists, social media, and tradeshow. The output of the lead management processes is qualified, scored, nurtured, augmented and prioritized leads that are identified and routed to direct, indirect or digital commerce sales channels for action and closure. Lead management integrates business processes and technology to close the loop between marketing and direct or indirect sales channels, and to drive higher-value opportunities through improved demand creation, nurturing and opportunity management.

A lead management product can be delivered as a stand-alone lead management technology but much more commonly it is delivered as part of a toolset and overall CRM strategy. It is typically integrated with sales execution/sales force automation (SFA) downstream and upstream with a multichannel marketing system.

For more information, see [Magic Quadrant for CRM Lead Management](#).

Account-Based Marketing

Account-based marketing (ABM) is an approach to traditional lead management processes that typically uses intent data, lead scoring, personalized content, multiple channels including programmatic advertising to target and engage specific identified accounts and individuals across all stages of the buying process. It is used to target unknown buyers in the early stages of the buying process and then nurture the relationships and engagement. Rather than working with individual contacts and leads, ABM approaches will handle all the leads, contacts and opportunities within an account organization, which itself may be made up of many buying units (subsidiaries and sister companies). The ABM market is maturing but still attracting new entrants and there are now vendors that provide more complete solutions or platforms.

For more information, see [Market Guide for Account-Based Marketing Platforms](#) and [Tech Go-to-Market: The Gartner Account-Based Marketing Vendor Guide for TSPs, 2017](#).

Multichannel Marketing

The multichannel marketing (MCM) market comprises vendors that seek to orchestrate and optimize company communications and marketing offer processes, and then engage through both inbound and outbound channels to customer segments across multichannel environments. These include websites, mobile (push, SMS, websites), social, direct mail, call centers and email. We also include marketing automation (typically B2B) and specialist email service providers in this definition.

Within MCM campaign management includes functionality for audience management and segmentation, campaign creation, campaign workflow, campaign execution and activation with multiple channels, analytics including attribution and customer journey analytics. Advanced execution functionality includes content management, event triggering and real-time decision making/offer management in inbound and outbound environments.

Digital capabilities include advertising management or integration with ad platforms, content marketing, mobile and social marketing, and web and email marketing. MCM extends the marketing process through channels such as the web, email, video, mobile and social applications, point-of-sale terminals, interactive TV, and digital signage and kiosks.

Mobile marketing platforms are also included in our definition.

Digital and Advertising Technologies

“Digital marketing” is a widely used term, and it would often cover aspects of marketing already defined, such as multichannel marketing hubs and lead management. In this taxonomy, we use this digital marketing category for any other class of marketing not already covered. Primarily, we refer to advertising technologies (ad tech).

Ad tech includes all technology that supports advertising activities, both digital and traditional (although most of it is digitally focused). “Programmatic” refers to the automation of buying and trafficking processes for audience-targeted ads. “Programmatic media” is defined as software services that automate, optimize and analyze the buying of slots for ad placement, often spanning multiple marketplaces. Programmatic originally focused on real-time bidding marketplaces (also known as ad exchanges). However, it has recently expanded to include models such as “programmatic direct,” which refers to the application of software to automate and optimize the placement of ads presold directly to advertisers by publishers at a human-negotiated price.

Key categories of digital and advertising tools include:

- **Data management platform (DMP)** – Software that ingests data from multiple sources (such as internal CRM systems and external data vendors) and makes it available to marketers to build segments and targets. This tool is essential to designing effective programmatic media campaigns (see [The Data Management Platform Endgame](#)).
- **Demand-side platform (DSP)** – Software that manages programmatic ad buying by monitoring and bidding on ad placement opportunities, usually based on available audience criteria. This is also an essential tool for executing programmatic media buys. DMPs and DSPs may be purchased together or separately.
- **Dynamic creative optimization (DCO)** – Software that selects and/or composes ads on the fly based on factors such as audience profile criteria, marketplace conditions and ambient circumstances (such as time of day and weather).

Loyalty Management

Loyalty management is used to increase wallet share and retention among existing customers as well as attract new customers. Common loyalty marketing platforms help drive retention and acquisition of customers through loyalty cards, membership rewards, discount clubs, advocacy, promotions/offers, referrals and other tactics. These platforms may also enable general-purpose personalization through the construction of a unified customer profile and drive decisioning capabilities around targeted offers. Managed services play a significant role in large enterprises for technology deployment as well as ongoing loyalty operations such as program management and execution.

Web Content Management

Gartner defines web content management (WCM) as the process of creating, managing and delivering content over one or more digital channels through the use of specific management solutions based on a core repository. These solutions may be procured as commercial products, open-source tools, cloud services or hosted services.

The functionality of WCM solutions goes beyond simply publishing webpages. It also includes:

- Content creation functions, such as templating, workflow and change management
- Repositories that organize and provide metadata about content
- Library services, such as check-in/check-out, version control and security

- Website management features, such as layout, menus and navigation
- Content deployment functions
- Personalization and analytics capabilities
- The ability to integrate well, via APIs, with adjacent technologies such as digital commerce platforms, social media platforms, marketing automation platforms and broader digital experience platforms (DXPs)
- Hybrid (traditional and headless) and pure headless capabilities for API-driven omnichannel content delivery

See the related definition of DXPs in this document within the application infrastructure and middleware (AIM) section and also [Magic Quadrant for Web Content Management](#).

Sales

Sales Force Automation

Sales execution (also called sales force automation) applications are foundational applications, implemented to support and automate most essential sales activities, processes and administrative responsibilities for B2B organizations' sales professionals. Core functionalities include account, contact and opportunity management, as well as sales forecasting and sales activity tracking.

For more information, see [Magic Quadrant for Sales Force Automation](#).

Sales Acceleration

Sales acceleration software automates administrative tasks and streamlines sales processes. They are designed with the goal of increasing sales velocity. The various touchpoints between buyers and vendors make it more difficult to create engaging and personalized experiences. In general, sales acceleration refers to applications that help organizations, mainly outbound-dedicated resources, to move prospects through the sales pipeline with greater efficiency.

Partner Relationship Management

Partner relationship management (PRM) applications support indirect sales channel processes with web-based capabilities to manage distributors, dealers, value-added resellers (VARs) and all types of sales partners in general. Vendors in this segment provide either comprehensive end-to-end solutions or specialized point solutions. Core categories of features include partner life cycle management functionalities, channel partner marketing systems, sales enablement and execution functionalities, and support partner services.

For more information, see [Market Guide for Partner Relationship Management Applications](#).

Sales Enablement

Sales enablement is a rapidly growing segment of CRM. Sales enablement processes have evolved rapidly in recent years, moving from a narrow focus on sales training into a practice and business discipline that drives sales execution best practices across the sales organization. Sales enablement platforms are tools that unite sales enablement functions with customer-facing sales execution. They predominantly support native content, sales training delivery and reinforcement, and sales coaching. They can be used for direct sales and indirect partner/channel enablement. The platform can include all three areas natively or use open APIs to connect to the complementary functions. If the latter, the relationship needs to be a selling relationship where integration has been prebuilt and data movement and sharing/synchronization is seamless between the applications to supply a better end-user experience. Sales enablement platforms also use APIs to support a wider array of functionality available via their ecosystems.

For more information, see [Market Guide for Sales Engagement Platforms](#).

Configure, Price and Quote

The configure, price and quote (CPQ) market supports traditional sales quote configuration, as well as self-service, e-commerce, contact center and partner channels. These solutions improve the guidance, governance and efficiencies of selling unique combinations of products or services for different sales situations. At the same time, they reduce the time spent on nonselling work and selling cycle times, and they improve overall sales effectiveness.

Competing sales CPQ application suites are evolving from the long-standing sales configuration software market. They are evolving to address the increasing demand for solutions that imbue meaningful improvements to lead-to-quote, lead-to-order-capture and related selling processes via automation.

Sales configuration applications, pricing engines and quoting are driven by organizations scrutinizing the integrated sales process (from lead/opportunity to order) and deciding to move beyond sales efficiency objectives, such as cycle times and error reductions. Their goals now are more strategic sales effectiveness objectives, such as overall deal profitability and order size.

This segment also includes tools for:

- Sales order management
- Sales contract management (supply side), where contracts are negotiated as well as applications where legacy contracts are ingested and intelligence derived from them
- Price management and optimization
- Sales proposal management systems

For more information, see [Magic Quadrant for Configure, Price and Quote Application Suites](#).

Sales Performance Management

Sales performance management (SPM) is a collection of operational and analytical functions that automate and unite operational sales processes. Capabilities include sales incentive compensation management (ICM), objective/quota management and planning, as well as territory management and planning. SPM solutions also provide modeling and analytic capabilities for businesses to evaluate sales assumptions and diagnosis trends in sales outcomes.

For more information, see [Magic Quadrant for Sales Performance Management](#).

Recurring Revenue Management

Companies with recurring revenue business models must manage these revenue streams from active customers as rigorously as they manage their new sales pipelines. Existing CRM systems assist in managing accounts, contacts and new opportunities, but companies must also capitalize on every customer-recurring opportunity to meet and exceed revenue targets. This need to recognize renewal revenue or recurring revenue on consistent schedules has created a new market originally for SaaS technology vendors. Legacy segments including vendors selling subscription management systems to utilities and content services platforms (CSPs) are also included in this definition.

Recurring revenue management is a back-office function that integrates with SFA, CPQ and ERP systems to manage the business rules that support recurring revenue streams. Vendors' capabilities include usage-based billing, pricing optimization, refund/rebate processes and customer life cycle management. This function's outputs are used in billing, renewal and customer success processes.

For more information, see [Competitive Landscape: Cloud Subscription and Recurring Billing Management, North America](#).

Customer Success

Customer success and life cycle tools integrate data from multiple sources, but primarily the CRM and subscription and usage billing systems. They provide overall health scores of accounts and provide rules, alerts and playbooks to allow sales, service and customer success agents to make sensible and guided decisions to manage the customer relationship.

Enterprise Resource Planning

Market Analysts: Chris Pang and John Kostoulas

See Table 5 for an overview.

Table 5: Enterprise Resource Planning Market Overview

(Enlarged table in Appendix)

Enterprise Resource Planning			
Enterprise Asset Management	Financial Management Systems	Human Capital Management	Manufacturing and Operations
<ul style="list-style-type: none"> Record Assets Capital Construction Planned Maintenance of Assets Reactive Work Management Disposal of Assets Maintenance, Repair and Operations Materials Management Resource Scheduling Condition Monitoring Mobile Workforce Support Reliability-Centered Maintenance 	<ul style="list-style-type: none"> Core Financial Applications Cash and Treasury Management Budgeting, Planning and Forecasting Other FMSs 	<ul style="list-style-type: none"> Administrative HR HR Service Management Talent Management Workforce Analytics Emerging HR Workforce Management Employee Expense Management Other HR Functions 	<ul style="list-style-type: none"> Production Planning and Scheduling Production Operations and Control Manufacturing Information Management

Source: Gartner (June 2021)

Notes for Table 5: FMS = financial management system; HR = human resources

Enterprise resource planning (ERP) is an application strategy focused on several distinct enterprise application suite markets. ERP applications automate and support more administrative and operational processes including manufacturing and maintenance/overhaul processes. Gartner segments ERP into four major business process areas.

Enterprise Asset Management

Evolving from computer(ized) maintenance management system applications that encompass work and materials management for fault repair, regular preventive maintenance and service, enterprise asset management (EAM) systems have been a key tool in asset care, maintenance, repair and overhaul. EAM applications are not limited to manufacturing. They also apply to utilities, facilities, transportation and other activities in which equipment subject to wear, failure or repair is used. EAM is a part of a strategy to increase plant capacity, using IT in lieu of new construction in large, asset-intensive enterprises. It integrates key plant control systems and ERP with maintenance activities and functions to reduce downtime and minimize maintenance spending. In its most complete form, EAM equates to an ERP solution for a nonmanufacturing environment, such as a utility, mining, defense or transportation operation. EAM functionality includes but is not limited to:

- Record assets (asset management)
- Capital construction
- Planned maintenance of assets
- Reactive work management
- Disposal of assets
- Maintenance, repair and operations materials management
- Resource scheduling (people)
- Condition monitoring
- Mobile workforce support
- Reliability-centered maintenance

Financial Management Systems

Financial management system (FMS) applications provide visibility into an enterprise's financial position through automation and process support for any activity that has a financial impact. They also provide financial reporting data as needed by local and international regulations. These applications include but are not limited to:

- Core financial applications:
 - General ledger.
 - Accounts payable.
 - Accounts receivable.
 - Fixed assets.
 - Project accounting.
- Cash and treasury management.
- Budgeting, planning and forecasting:
 - Financial consolidation and close management.
 - Financial and management reporting.
 - Enhanced financial controls and automation.
 - Financial budgeting, planning and forecasting.
 - Integrated financial planning.
 - Profitability modeling and optimization (PM&O).
 - Strategy management:
 - Scorecards and strategy maps.
 - Initiative/goal management.
 - Dashboards.
- Other FMSs:
 - Enhanced financial controls and automation.
 - Accounts payable invoice automation.
 - Collection and deduction management.
 - Tax management.

Human Capital Management

Human capital management (HCM) is a set of practices related to people resource management. These practices encompass several functional areas that can be used stand-alone or in conjunction with one another, from the same or different providers.

- Administrative HR:
 - Core HR (organizational and employee data, employment life cycle processes, and transactional employee and manager self-service).
 - Benefits administration.
 - Payroll administration.
- HR service management (HRSM):
 - Content/guidance employee/manager portal.
 - Case management/knowledge base.
 - Digital document management.
- Talent management:
 - Recruiting.
 - Onboarding.
 - Performance management.
 - Compensation planning.
 - Career and succession planning.
 - Learning and development.
 - Workforce planning.
- Workforce analytics.

- Emerging HR:
 - Recognition and rewards.
 - Voice of the employee.
- Workforce management:
 - Absence management.
 - Time and attendance.
 - Workforce scheduling and forecasting.
- Employee expense management.
- Other HR functions.

Manufacturing and Operations

The manufacturing and operations segment comprises stand-alone and application software suites that help automate the manufacturing process. The functionality comprised within this segment includes, but is not limited to, manufacturing execution, master production scheduling and material requirements. Applications include:

- Production planning and scheduling:
 - Manufacturing resource planning (MRP).
 - Production planning (for discrete, batch and process industries).
 - Production scheduling.
- Production operations and control:
 - Manufacturing operations management (including manufacturing execution systems [MES]).
 - Quality control systems.
 - Shop floor control (including lean/flow control).
- Manufacturing information management.

Content Services

Market Analyst: Craig Roth

The content services market contains many subsegments — imaging and document workflow, records management and structured content creation, to name just a few. However, Gartner tracks only two for market share purposes:

1. Content collaboration tools (CCTs), an expansion of the enterprise file synchronization and sharing (EFSS) market.
2. Content services platforms (CSPs), formerly known as enterprise content management (ECM).

Content Collaboration Tools

CCTs enable content-centric productivity and collaboration for individuals and teams, inside or outside an organization. Core functionalities include mobile access to content repositories, file synchronization and sharing, and file search across repositories. In addition, CCTs support collaborative document creation, teamwork, lightweight content management and workflow automation, natively or through integration with third-party tools. Deployments can be in public, hybrid or private clouds, or on-premises.

CCTs originated from the EFSS market, which emerged in 2010 and evolved through commoditization, forcing vendors to expand their value propositions. From their initial focus on EFSS, offerings were expanded with specialized capabilities to support content-driven collaboration for individuals and teams, secure external collaboration, lightweight content management, and file-centric workflows. In addition, these products increasingly acquired a platform character, adding APIs to access the associated content repository, connectors to external repositories, UI customization and modeling tools. CCTs now also offer support for IT management and administration, as well as security, analytics and governance capabilities.

Content Services Platforms

Enterprises depend on a wide array of software for managing the full life cycle of content – from the first time it is saved, through using it as part of a business process, and ending with archiving or deletion. While this category used to be called “enterprise content management,” that term no longer reflects market dynamics or the organizational needs for content in digital business. Organizations typically seek (and buy) content solutions to support business processes or broader digital workplace initiatives, as opposed to generic platforms and functional capabilities. “Management” has become less important than actually using the content to communicate or make decisions.

Accordingly, Gartner tracks the more broadly defined “content services” market. Content services are a set of services and microservices, embodied either as an integrated product suite or as separate applications that share common APIs and repositories. Their purpose is to exploit diverse content types and to serve multiple constituencies and numerous use cases across an organization.

Under this designation, there are three categories of content services:

1. **Content Services Platforms** – These represent the evolution of the content repository and include the evolution of traditional ECM vendors. A CSP has its own repository and may also integrate external repositories through connectors and APIs or packaged integrations. CSP providers offer integrated sets of content services applications (most, if not all of the horizontal applications listed in the following point) built on content services components. CSPs are available on-premises, in the cloud or in hybrid architectures.

2. **Content Services Applications** — Content services applications are capabilities aggregated by content services platforms that provide a solution to a distinct, content-driven business problem. Both vertical services (designed to serve a particular vertical business problem) and horizontal services (designed to solve problems common across industries) exist. Examples of vertical content services applications include case management, customer communications management, invoice automation, loan origination, claims processing and specialized business process applications. Examples of horizontal content services applications are:
 - **Document Management** — For check-in/check-out, version control, security and library services for business documents. Advanced capabilities may include compound document support, digital rights management, metadata-driven views of documents, mobile user experiences and integration with common productivity applications.
 - **Records Management** — For long-term archiving, automating policies for retention and compliance requirements, e-discovery support, and ensuring legal, regulatory and industry compliance. The minimum requirement is an ability to enforce immutable retention of critical business documents, based on a record retention schedule. More advanced solutions provide certified compliance with standards such as the Department of Defense (DoD) Directive 5015.2-STD, the Victorian Electronic Records Strategy (VERS) and Modular Requirements for the Management of Electronic Records (MoReq).
 - **Image-Processing Applications** — For capturing, transforming and managing images of paper documents. This includes document capture (scanning hardware and software, mobile device capture, optical and intelligent character recognition technologies, and form-processing technology) performed either using native capabilities or through a formal partnership with a third-party solution provider. It also includes the ability to store images of scanned documents as a native (nonrendered or converted) content type in a folder, and to route them through an electronic process.
 - **Content Workflow** — For supporting business processes, routing content, assigning work tasks, determining states and creating audit trails. This can range from simple document review and approval workflow capability to graphical process builders with parallel routing and out-of-the-box, industry-specific workflows.

- **Content Analytics** — For analyzing file content, discovery or interrogation of enterprise content, tagging patterns and user activity. Calculating document value (“content ROI”) is a ripe area for content analytics.
 - **Content Collaboration Tools** — Content collaboration tools provide a modern replacement for the file system and help employees access and use content in their day-to-day activities. Core features include file sharing, device synchronization and the provision of collaborative workspaces. Gartner is shifting to calling these products “content collaboration tools.”
3. **Content Services Components** — Content services platforms have a base set of services and microservices that are combined to build content services applications. Components generally do not have their own repositories, but rather manipulate content in repositories owned by content services platforms and applications.

Gartner market share data tracks CSPs and CCTs. Other types of content services applications and components are not tracked or included in the revenue totals.

Email and Authoring

Market Analyst: Craig Roth

This market consists of two product categories that are used as part of a collection — often customer-assembled — of personal and team productivity applications that Gartner calls the “new work hub.” Email and authoring are generally purchased together as part of an “office suite” or a “productivity suite.” Gartner tracks only email and authoring software targeted at enterprises. Where a single price is paid for a suite containing email and authoring, an allocation has been made to assign a portion to cover email and general-purpose content creation applications to this category. Calendaring is included as part of email as well.

Authoring software is a collection of general-purpose content creation applications for tasks such as word processing, spreadsheet manipulation and presentation graphics. Subscription models for office suites are now the norm.

Project and Portfolio Management

Market Analyst: Neha Gupta

Project and portfolio management (PPM) applications’ core functions include:

- Project planning
- Detailed scheduling (or integration with desktop scheduler)
- Interdependency tracking (dependent projects in programs)
- Time tracking
- Progress reporting
- Resource profiling and allocation
- Workflow for projects, programs and portfolio processes
- Portfolio analysis and prioritization

As PPM products evolve to support more mature project management offices (PMOs), functionality will include:

- Extended collaboration (such as via social and mobile)
- Benefits tracking
- Business case development (in the tool)

PPM applications support an integrated view across the portfolio of resource effort, including both project and nonproject work. Organizational resource information can be grouped into taxonomies of roles, functions and skill sets, thus allowing for better tracking of resource assignment and utilization. PPM applications also support integrated planning of multiple, dependent projects in programs, with a view of cross-project dependencies, program-level budgets, costs, schedules and resource plans, and with flexible reporting of project and program data. Applications allow for logging project problems and issues, as well as analyzing the impact of proposed changes.

Portfolio management supports decision making that aligns initiative investments with business value, and it also features mechanisms to review benefits realization. Functions provide BI on project or service delivery and dashboard views of initiative alignment, schedule and budget variances, resource capacity, service levels, and more.

Supply Chain Management

Market Analysts: Balaji Abbabatulla and Chad Eschinger

See Table 6 for an overview.

Table 6: Supply Chain Management Market Overview

Supply Chain Management		
Supply Chain Planning	Supply Chain Execution	Procurement and Sourcing
<ul style="list-style-type: none"> ■ Demand Planning ■ Inventory Optimization ■ Production and Distribution Planning ■ Sales and Operations Planning ■ Service Parts Planning ■ Strategic Network Design ■ Supply Chain Performance Management/Analytics 	<ul style="list-style-type: none"> ■ Distributed Order Management ■ Warehouse Management System ■ Transportation Management System ■ Global Trade Management 	<ul style="list-style-type: none"> ■ Accounts Payable Invoice Automation ■ Contract Life Cycle Management ■ E-Procurement ■ E-Sourcing ■ Procurement Networks ■ Services Procurement ■ Spend Analytics ■ Supplier E-Invoicing ■ Supplier Management

Source: Gartner (June 2021)

Supply chain management (SCM) is a business strategy to improve shareholder and customer value by optimizing the flow of products, services and related information from source to customer. SCM encompasses the processes of creating and fulfilling the market's demand for goods and services. It is a set of business processes that encompasses a trading partner community engaged in a common goal of satisfying the end customer. Thus, a supply chain process can stretch from a supplier's supplier to a customer's customer.

At a high level, SCM software is segmented into planning, execution and procurement and sourcing market segments. Planning typically deals with activities to develop demand forecasts, establish relations with suppliers, plan and schedule manufacturing, and develop metrics to ensure efficient and cost-effective operations. Execution functions manage the processes and activities to ensure completion of the plans, including creating purchase orders, taking customer orders, updating inventory, managing movement of products in the warehouse, and delivering goods to the customer. Procurement applications are used to help companies improve efficiency and visibility of indirect spend, as well as improve effectiveness and reduce costs of direct spend. Sourcing applications enable companies to digitize and optimize sourcing decisions, as well as improve supplier engagement and contract life cycle management.

Supply Chain Planning

Supply chain planning (SCP) is the forward-looking process of coordinating assets to optimize the delivery of goods, services and information from supplier to customer, balancing supply and demand. An SCP suite sits on top of a transactional system to provide planning, what-if scenario analysis capabilities, and real-time demand commitments, considering constraints. Typical modules include:

- **Demand planning** — The process for creating a forward-looking view of anticipated customer demand and the process of forecasting and managing the demand for products and services by end users, as well as by intermediate supply chain members.
- **Inventory optimization** — Determines the correct levels of inventory across the network, based on demand variability at the lowest customer-facing nodes, the lead time and lead-time variations at all the higher echelons. This approach avoids solving a sequence of subexercises for each echelon, and it accounts for uncertainty.
 - Collaborative planning (including forecasting and replenishment).
 - Event planning (promotion, life cycle).
 - Inventory planning.
 - Inventory strategy optimization (simultaneous, multitiered).

- **Production and distribution planning:**
 - Available to promise.
 - Capable to promise.
 - Distribution planning (unconstrained, distribution requirements planning [DRP] and deployment).
 - Production/factory planning and scheduling.
 - Supply planning (optimized, DRP and deployment).
 - Vendor-managed inventory.

- **Sales and operations planning (S&OP) and integrated business planning** – A performance-based, cross-functional business process that harmonizes and aligns operational plans across sales, marketing, procurement, manufacturing, distribution, product development and finance. Gartner positions S&OP as the key value trade-off process between demand, supply and product within a demand-driven supply chain strategy. To achieve S&OP excellence requires the use of technology to support the harmonization of operational plans, such as demand, supply, production and new product introduction, as well as supporting key value trade-off decisions across the value chain. It is linked to performance management technology, such as dashboards and scorecards, and can support the management of running an effective process.

- **Service parts planning (SPP)** — Supports the optimal stock quantities and location of items used to service internal assets or customer equipment in the aftermarket. SPP applications address processes such as:
 - Forecasting and demand planning.
 - Inventory planning and optimization.
 - Distribution/allocation and supply planning.
 - Collaboration workforce planning.
 - Analytics and business activity monitoring (BAM), such as visibility and event management.
 - Pricing optimization.
 - Returns and repair center management.

- **Strategic network design** — Historically, solutions were used strategically (one to five years) to determine the overall optimal physical supply/demand network (for example, plants, distribution centers and warehouses), considering costs and service goals and objectives. More recently, network design/planning tools have been enhanced for use in tactical business planning scenarios (less than one year). An example would be to answer such questions as what the company's channel strategies should be, or what the impact would be of switching suppliers or global sources of supply. Most recently, environmental factors, such as carbon footprint, have been added to these types of solutions to enable optimization around environmental parameters.

- **Supply chain performance management/analytics** — A technology-enabled discipline that includes:
 - The performance-driven processes used to help manage “assets” (such as customer service, orders, costs, inventory, physical assets, operational plans, tasks and activities) across an end-to-end supply chain.
 - The methodologies that drive some processes (such as the balanced scorecard, value-based management or root cause analysis [RCA]).
 - The metrics used to measure performance against strategic, operational and tactical performance objectives (for example, using the Supply Chain Operations Reference Model).

Supply Chain Execution

Supply chain execution (SCE) is focused on execution-oriented applications. These include warehouse management systems (WMSs), transportation management systems (TMSs) and global trade management (GTM) systems. SCE also includes other execution applications, such as real-time decision support systems (for example, dynamic routing and dynamic sourcing systems) and supply chain visibility systems within the enterprise, as well as throughout the extended supply chain. Distributed order management (DOM) systems are also included in SCE. Typical modules and applications include:

- **DOM** — A commercial instantiation of a customer-centric order management framework, along with the services, process models, UI designs and business rules with which to operate this order management process. A high-level view of Gartner's general model for a customer-centric order management framework is "quote, capture, decompose, orchestrate/promise, execute, settle." A DOM solution provides a set of commercial best-practice models for supporting this overall framework.

- **WMS** — A software application that manages the operations of a warehouse or distribution center. Application functionality includes receiving, put-away, inventory management, cycle counting, task interleaving, wave planning, order allocation, order picking, replenishment, packing, shipping, labor management and automated material-handling equipment interfaces. The use of radio frequency (RF) technology in conjunction with bar codes provides the foundation for a WMS, delivering accurate information in real time. Other functionality includes:
 - Inspection/quality assurance.
 - Cross-docking.
 - Location management.
 - Wave management.
 - Staging.
 - Truck loading.
 - Manifesting.
 - Yard management.
 - Slotting.
 - Parcel manifest.
 - Dock scheduling.
 - Reverse logistics/returns management.

- **TMS** — Generically refers to a category of software that deals with the planning and execution of the external physical movement (transportation) of goods across supply chains. Multiple subcomponents make up comprehensive TMS solutions across:
 - Planning and optimization (for example, load consolidation, routing, mode selection and carrier selection).
 - Execution (for example, tendering loads to carriers, shipment track and trace, freight audit and payment).
 - Visibility and performance management (for example, global visibility, event management, BAM, track and trace, and analytics).
 - At a minimum, TMS solutions are used to manage freight planning and execution. In addition, TMS suites have been extended to include all transportation management functions, from the strategic planning and sourcing of freight to the visibility of freight, payment services and audit capabilities. Other functionalities include:
 - Strategic/tactical planning.
 - Strategic sourcing.
 - Collaborative tactical planning.
 - Transportation execution and carrier communication.
 - Parcel shipping.
 - Fleet planning and scheduling.
 - Load building/design.
 - Freight rating and contract management.
 - Freight billing.
 - Visibility and event management (track and trace).
- **GTM** — Comprises the knowledge, processes and technologies used to support the often complex and unique logistical, regulatory and financial aspects of the import and export processes associated with international (such as cross-border) shipments.

Procurement and Sourcing

Procurement and sourcing software applications support business processes required for transactional procurement and strategic sourcing. These processes enable users to search and order goods and services, identify and manage suppliers, solicit and analyze proposals, analyze and optimize spend, as well as negotiate and manage contractual terms to balance cost, quality and risk.

Procurement and sourcing software applications support such business processes either through a “suite” of software applications or through best-of-breed software applications.

Procurement and sourcing software suites support the following business processes:

- **Procure to pay** — All business processes required for users to search products and services, create a B2B purchase order, place an order with a supplier, manage catalogs, integrate with and manage B2B marketplaces and supplier networks, receive products and services from the suppliers, accept and process supplier invoices, and approve and sometimes execute B2B payments.
- **Strategic sourcing** — All business processes required for business users to create a requisition, sourcing users to identify appropriate suppliers, create and execute RFIs and RFPs, solicit and evaluate bids from suppliers, negotiate contractual terms, select suppliers and place orders, optimize sourcing spend, create visibility about spend, store and manage contracts, manage supply base information, and improve supplier engagement.

Best-of-breed procurement and sourcing software applications support the following processes:

- **Accounts payable invoice automation** — B2B supplier invoice approval, discrepancy resolution, auditing, payment period approval and initiation of payment transaction.
- **Contract life cycle management** — Primarily buy-side/procurement and sourcing contract negotiation, storage, retrieval authoring, review and obligation management.
- **E-procurement** — Users search for products and services, create a B2B purchase order, place an order with a supplier, spend visibility, spend policy compliance, and receive products and services.

- **E-sourcing** — Business users need to create a requisition, sourcing users need to identify appropriate suppliers, create and execute RFIs and RFPs, solicit and evaluate bids from suppliers, negotiate contractual terms, select suppliers and place orders, and optimize sourcing spend.
- **Procurement networks** — Catalog-based e-procurement through supplier networks, including catalog management and supplier information management, primarily for indirect transactions.
- **Services procurement** — Find, onboard, pay, manage and offboard temporary workers; often includes procurement and management of deliverables/milestone-based services. These applications are also known as vendor management system or contingent workforce management.
- **Spend analytics** — E-sourcing spend visibility and reporting, identifying exceptions such as noncompliant spend and fraudulent transactions, and triggering approval workflows. It includes processes required to extract, cleanse and manage data, as well as associated ML algorithms.
- **Supplier e-invoicing** — Receive, validate and archive B2B invoices received from suppliers in an electronic format that may include managed file transfer (MFT), electronic data interchange (EDI), portal-based stand-alone invoices, PDF documents, XML transfers and other forms of automated data exchange.
- **Supplier management** — Supplier discovery, supplier information management (approvals, document management), supplier risk management, supplier performance management, supplier enrichment supported by survey tools and scorecards.

Other Application Software

Market Analyst: Neha Gupta

Other application software includes, but is not limited to, virtual assistants (including chatbots), document capture or intelligent document processing (IDP) software, computer-aided application (CAx) and architecture, engineering and construction (AEC) software, collaboration, digital content creation (DCC), e-discovery, enterprise IM, web conferencing, engineering applications, enterprise search, and stand-alone mobile and wireless applications. The segment also includes other application software that is reported in vendors' income statements but is not reported in our Market Share publications.

For Gartner market share purposes, “other application software” covers the categories previously listed. However, it does not include vertical-specific software, which is defined as software applications that are unique to a vertical industry and which are stand-alone applications that are not modules or extensions of horizontal applications.

Collaboration Services

Collaboration is goal-focused and often centered on documents and other forms of content, processes and projects. General purpose, enterprise social software suites provide shareable virtual workspaces that contain artifacts such as documents, pages of text, images and tools for activities, such as shared discussions or project calendars. Wikis and team sites are common types of collaboration spaces.

Workspace-oriented products and services often include or integrate with additional services, such as presence awareness. Synchronization services are often included in workspace-oriented offerings in order to facilitate offline work and flexible workspace distribution.

Workstream collaboration (WSC) creates a persistent, shared conversational workspace that assists teams with initiating, organizing and completing work. The core capabilities of WSC include persistent messaging, alerts, notifications, search, archiving, activity streams and content-sharing functionalities. WSC tools typically connect with other business and consumer applications via APIs and bots.

Enterprise social software applications are an offshoot of collaboration suites that are focused on people. They facilitate, capture and organize open conversations and information sharing between individual workers and groups within an organization. They have capabilities that support conversations and information sharing. These applications help people find out about each other, have discussions, share information and generally interact.

Enterprise IM

IM is a communications service in which short messages appear in pop-up screens as soon as they are received, thereby commanding the recipient’s immediate attention. Most IM services offer presence information that indicates if the user is online and available to send and receive messages. These services also provide “buddy lists” that are groups of people who have been selected by the user for frequent access, as well as group-based chat services. Enterprise IM provides real-time message passing within private and public networks.

Web Conferencing

Web conferencing represents one form of real-time collaboration. It consists of real-time electronic meeting and content delivery, desktop and application sharing, IM, and group document markup with electronic whiteboarding. It is augmented by audio, data and video, security (encrypted data transfer, password protection), and remote control (a participant can control applications of another device). More advanced features include native mobile applications, HTML5 support, integrated voice over Internet Protocol (VoIP) audio, file sharing, videoconferencing, content archiving, media streaming, feedback, polling and replay. Real-time collaboration technologies not included in the web-conferencing category are stand-alone IM, audioconferencing and videoconferencing.

Infrastructure Software Definitions

The focus of infrastructure software is to build, run and manage the performance of IT resources. In this category, we gather software primarily for use by IT professionals.

Application Development

Market Analyst: Laurie Wurster

See Table 7 for an overview.

Table 7: Application Development Market Overview

(Enlarged table in Appendix)

Application Development		
Plan	Create	Verify
<ul style="list-style-type: none"> ■ adPaaS ■ Enterprise Agile Planning Tools <ul style="list-style-type: none"> ■ Frameworks ■ Requirements Definition and Management ■ Product Roadmapping Tools ■ Conversational User Interfaces ■ Design <ul style="list-style-type: none"> ■ Continuous Experience ■ Event-Driven Programming Models ■ Mediated API ■ API Economy ■ Database Design ■ Object-Oriented Analysis and Design ■ UX Tools ■ Other ADLM ■ Post-Scrum Methodologies 	<ul style="list-style-type: none"> ■ Build <ul style="list-style-type: none"> ■ Event-Driven Web ■ Agile Development ■ Behavior-Driven Development ■ Hypothesis-Driven Development ■ Multiexperience Development Platforms (MXDP) ■ Citizen Automation and Development Platform (CADP), Rapid Application Development (RAD) and Rapid Mobile Application Development (RMAD) ■ Code <ul style="list-style-type: none"> ■ Java Platform AD Tools ■ Microsoft .NET Platform AD Tools ■ Language-Oriented Development Environments ■ Dynamic Web Application Tools ■ Intelligent Device Development Tools ■ Public Web APIs ■ Reactive Programming ■ Configure <ul style="list-style-type: none"> ■ Application Portfolio Management 	<ul style="list-style-type: none"> ■ Automated Testing ■ Cloud Testing ■ DevOps Application Testing ■ Quality Engineering ■ Service-Oriented Architecture Testing ■ Test Data Management ■ Application Development Mainframe Tools ■ Other AD

Source: Gartner (June 2021)

Notes for Table 7: AD = application development; ADLM = application development life cycle management; adPaaS = application development platform as a service; API = application programming interface; CADP = Citizen Automation and Development Platform; MXDP = multiexperience development platform; RAD = rapid application development; RMAD = rapid mobile application development; UX = user experience

The application development (AD) software market comprises tools that represent each phase of the software development life cycle (plan, create and verify, as well as AD development mainframe tools, and other AD software).

Plan

This section includes the tools used in the design and planning stages of application development, regardless of methodologies used – waterfall development, agile development and rapid application development (RAD).

adPaaS

Application development platform as a service (adPaaS) solutions are defined as cloud-delivered development tools, designed to support a DevOps toolchain and exhibit extensibility through partner marketplaces and services, events and APIs. These platforms are designed around driving collaboration and enabling continuous processes.

Enterprise Agile Planning Tools

Enterprise agile planning (EAP) tools help organizations make use of agile practices at scale to achieve enterprise-class agile development. This is achieved by supporting practices that are business-outcome-driven, customer-centric, collaborative and cooperative, as well as having continual stakeholder feedback. These tools represent an evolution from project-centric agile tools and traditional application development life cycle management (ADLM) tools. The majority of products in the EAP tool market play into the overall ADLM product set, acting as a hub for the definition and management of work item tracking.

Frameworks provide organizations with architectures and practices that enable and facilitate complex agile products. They can also be used to implement, upgrade, migrate and enhance commercial off-the-shelf (COTS) and cloud solutions. New roles and processes, structures and principles characterize a wide range of enterprise agile framework options for organizations to consider. Their purpose is to make the management of complex agile releases and evolving solutions not only feasible, but also routine and sustainable.

Requirements Definition and Management

Requirements tools encompass a broad set of solutions designed to aid in the gathering and management of documents supporting the definition and development of a software product. Tools may be delivered as either on-premises or cloud solutions. Management tools focus on managing changes and versions, including comments and discussions; approvals and reporting; and traceability between artifacts and analytics. Management tools increasingly provide a broader set of functionality that includes visualization, analysis of documents or models, communication and collaboration via wikis and other conversation formats, and compliance assistance (such as U.S. Food and Drug Administration [FDA] regulatory templates).

Product Roadmapping Tools

Product roadmapping tools help product managers and organizations define and prioritize work on product capabilities, features and outcomes. They record and measure product management tasks to improve collaboration with business stakeholders by ranking ideas, collecting feedback, tracking feature changes and providing data-driven analytics to define better roadmaps. These tools can also support sharing of centralized notes, provision of access control, generation of reports and extension of services via APIs.

Conversational User Interfaces

A conversational UI (CUI) is a high-level design model in which user and machine interactions primarily occur in the user's spoken or written natural language. Typically informal and bidirectional, these interactions range from simple utterances (like "Stop," "OK" or "What time is it?") to highly complex interactions (for example, collecting oral testimony from crime witnesses) and highly complex results. As design models, CUI depends on implementation via applications or related services, or on a conversational platform.

Design

- **Continuous experience:** A continuous experience preserves the continuity of user experience across traditional boundaries of devices, time and space. Users interact with an organization in a multistep sequence that may last through an extended period. The experience seamlessly flows across multiple devices and interaction channels (both digital and physical) that fulfill the user's journey. Channels include mobile devices, sensors, web, social, digital assistants, voice, messaging, email, print, call center and in-store channels.
- **Event-driven programming models:** These are application models that allow various components — such as apps, services or databases — to accept and react to events (as opposed to commands), resulting in more events. In such a model, the source and the target emit and process events without knowing about each other, leading to loosely coupled, highly resilient systems.
- **Mediated API:** A mediated API is a design pattern in which an API is virtualized, managed, protected and enriched by a mediation layer. This layer can enforce policy and inject capabilities into the API interaction for increased agility, usability, performance, security and control. A mediated API allows a service to expose an "inner API" that directly reflects its domain model, and one or more "outer APIs" tailored to support specific client requirements. Gartner previously referred to this pattern as software-defined application services (SDASs).

- **API economy:** The API economy is a set of business models and channels offered through an API, either within a company or using the internet. It is based on secure access of functionality and exchange of data to an ecosystem of developers and the users of the app constructs they build.
- **Database design:** This includes logical (entity relationship) and physical (table, column and key) design tools for data. Physical data modeling is becoming almost mandatory for applications using RDBMSs. Strong support for physical modeling is paired with facilities to manage multiple models, to submodel or extract from larger models, and to reverse-engineer a database design from established tables. Data architects/analysts and database designers/administrators are the primary targeted users of these tools, although developers are a secondary market often targeted with a subset of the complete functionality.
- **Object-oriented analysis and design (OOA&D):** OOA&D tools support object analysis and design technologies and commonly use Unified Modeling Language (UML) notation with a variety of methodologies to assist in the creation of highly modular and reusable software. Most also support the use of domain-specific language concepts as a complement to UML. Applications, data, networks and computing systems are treated as objects that can be mixed and matched flexibly rather than as components of a system with built-in relationships. As a result, an application does not need to be tied to a specific system, or data to a specific application.
- **UX tools:** UX tools are the software products used to automate or streamline steps through a digital design process that, in turn, empowers digital design teams. These products include, but are not limited to, those for wireframing, prototyping, journey mapping and persona management.

Other ADLM

This category includes tools providing other combinations of functions for the planning, control, measurement and reporting of the AD life cycle process not included in requirements definition and management, software change and configuration management (SCCM) or test management. This category includes, but is not restricted to, stand-alone tools for development method guidance, change management tools, and stand-alone tools for measuring or reporting the status of development activities and software composition analysis (operations support system [OSS] logistics).

Software composition analysis is a technology that analyzes application composition to detect components known to have security and/or functionality vulnerabilities, or that require proper licensing. Software composition analysis does not inspect components internally (that is, it does not conduct components' code analysis), but it tags them with information collected from sources such as OSS communities. That information typically includes intellectual property ownership, known security and functionality vulnerabilities, known remedies for those vulnerabilities, and references to the outdated and most recent versions of components, along with their locations on the web.

Post-Scrum Methodologies

Post-Scrum methodologies combine the principles and practices of agile software development with those of lean manufacturing to enable a continuous stream of value. Fixed iterations are replaced by the continuous development and delivery of new software, while formal, prescribed ceremonies are used only as necessary. Post-Scrum methodologies demand mature teams with an excellent knowledge of agile and lean, as well as solid technical practices and tools to enable continuous delivery.

Create

The create section includes the tools used to build, code and configure software applications.

Build

- **Event-driven web** — Event-driven web refers to the use of frameworks and libraries that support a threadless, nonblocking input/output (I/O) event-processing model for web applications, as opposed to thread-based or process-based approaches to handling concurrent requests.
- **Agile development** — Enterprise-class agile development (EAD) is the use of business-outcome-driven, customer-centric, collaborative and cooperative practices with continual stakeholder feedback. Feedback is done in dynamic and changing heterogeneous environments throughout the software life cycle, to support continuous delivery of enterprise-class adaptive products and services.
- **Behavior-driven development (BDD)** — BDD is a close relative of test-driven development (TDD) and acceptance-test-driven development (ATDD). All three are practices in which the desired behavior of software is written prior to the actual code. TDD and ATDD describe tests in a technical way that is familiar to development and test engineers. However, BDD expresses requirements as behaviors linked to business outcomes in a way that can enhance collaboration between end users, business analysts, developers and testers.

- **Hypothesis-driven development (HDD)** — HDD is software development based on running a series of tests in production to find the best solution. This is most appropriate where it is difficult or impossible to appoint a representative product owner due to a large and diverse user base or a user base that is entirely outside the organization building the code. The core principle is that every release is a test of a hypothesis and is constructed to be the simplest way to prove or disprove the hypothesis.
- **Multiexperience development platforms (MXDPs)** — A multiexperience development platform offers development teams an opinionated and integrated set of front-end development tools and “backends for frontends” (BFF) services. Its purpose is to enable distributed and scalable development (both in teams and architecture) of fit-for-purpose apps across digital touchpoints and interaction modalities.

Code

- **Java platform AD tools** — The Java platform AD tool market includes tools used to construct applications that operate within Java Community Process (JCP)-certified and JCP-compliant Java runtimes. These tools may include code-centric integrated development environments (IDEs), or they may employ more advanced features, such as model-driven code generators or other architected rapid AD features.
- **Microsoft .NET platform AD tools** — The Microsoft .NET platform AD tool market includes tools used to construct applications that operate within the Microsoft .NET managed code platform. These tools may include code-centric IDEs or they may employ more advanced features, such as model-driven code generators or other architected rapid AD features.
- **Language-oriented development environments** — Typically, these are development environments for code targeted to deploy to distributed platforms (Windows, Linux, UNIX) built on a compiler and a language. Language-oriented development environments generally include GUI builders, debuggers, editors and other utilities that are integrated into the environment. This market also includes proprietary fourth-generation language tools. It excludes products specifically targeted at deploying to either Java or .NET. It includes revenue for products such as SAP/Appeon PowerBuilder and Microsoft Visual Basic 6.0 to the extent they target proprietary runtimes. It also includes languages such as COBOL, C/C++, FORTRAN, Ada and Pascal that target proprietary runtimes on distributed platforms.

- **Dynamic web application tools** — The dynamic web application tool market includes tools that support interpreted and dynamic languages, such as Perl, Python, PHP, Ruby and ECMAScript. These tools are focused primarily (although not exclusively) on combining traditional IDE features with web design features.
- **Intelligent device development tools** — Tools for real-time and embedded systems include the software that is incorporated within devices such as medical instruments, smart meters or cars. They tend to be different from other AD tools in that they have a strong focus on domain-specific modeling languages, such as SysML, SDL or MARTE. Such tools can include model editors for software and system design, emulation, simulation, generation and automated testing. The tools support product life cycle management processes. Specifically, they support system engineering and the software aspects of product design and development.
- **Public web APIs** — Public web APIs expose application capabilities outside the organization and are for use by developers. Many public web APIs are available, delivering capabilities such as telephony, deep learning algorithms, mapping and facial recognition. Consumers include mobile apps, web applications, chatbots and virtual personal assistants. An API developer portal is frequently used to enable sign-up and self-service use of public web APIs. A number of business models for API monetization, both direct and indirect, are used for public web APIs.
- **Reactive programming** — Reactive programming is a program design model that focuses on data flows and the propagation of changing data values. Reactive programming technologies and best practices also incorporate elements of event-driven programming — namely, asynchronous and nonblocking request/response sequences.

Configure

- **Application portfolio management (APM)** — APM is the foundation of application strategy. APM profiles an organization's business applications, evaluating business value and technology fitness, together with cost and risk, to identify and prioritize activities for improvement. Application portfolio rationalization and modernization are achieved by the execution of strategies to tolerate, invest, migrate or eliminate assets.

Verify

These tools are used as part of the verification and validation process of checking to make sure that software meets the specifications and fulfills the intended purpose.

Automated Testing

Automated testing applies to commercially or internally developed software or services to assist in the testing process, including functional and load/stress testing. Automated tests provide consistent results and data points. The benefits are ease of maintenance, the ability to efficiently use resources in off-peak hours and the capability to create reports based on the executed tests. Tools included are testing apps on devices, cross-browser/device testing, device management, service testing, service virtualization and test lab management.

See [Magic Quadrant for Software Test Automation](#).

Cloud Testing

Cloud testing tools and services involve the use of cloud technology to support testing from or in the cloud. This includes cloud-based lab management, service virtualization, on-demand-delivered testing tools and device clouds. This term also covers support for large-scale load and performance tests, strong technology coverage (middleware, message formats, security protocols and so on) and the ability to work across applications using a mixture of technologies.

DevOps Application Testing

DevOps application testing reflects the process and tools to verify and release application development and operational application changes to production on a continuous basis.

Quality Engineering

Quality engineering is the application of lessons learned and intellectual property generated through quality assurance to engineer better business, IT or operational technology (OT) processes, products, solutions, services and applications from the outset of a development project.

Service-Oriented Architecture Testing

Service-oriented architecture (SOA) testing tools are designed for application interface testing without a GUI. As such, they are mainly aimed at testing “headless” components, such as web services, enterprise service buses (ESBs) and process models. They include solutions for automating the testing functionality and/or performance for APIs or web services, as well as simulating or “virtualizing” interdependent components. SOA testing can enable testing below the UI, resulting in more robust tests.

Test Data Management

Test data management (TDM) is the process of creating realistic test data for use in development, testing and training. Tools are used to extract and manipulate data from production or to generate synthetic fresh data, which is useful for boundary condition testing. Vendors also provide support for masking sensitive information.

Application Development Mainframe Tools

Included here are tools for mainframe development. See the description of each category for details. A roll-up of mainframe categories captured here are:

- Language-oriented development environments
- Software change and configuration management (SCCM)
- Testing

Other AD

This segment includes a roll-up of any AD tool not covered within named categories detailed previously. Included in the category are products for software design and construction, as well as tools for gaming and embedded software development.

Gaming Tools — Tools for gaming software development include 3D modeling tools and rendering engines.

Application Infrastructure and Middleware

Market Analysts: Fabrizio Biscotti and Bindi Bhullar

See Tables 8, 9 and 10 for an overview.

Table 8: Application Infrastructure and Middleware Market Overview (1)

Application Infrastructure and Middleware (1)				
Transaction Processing Monitors	Application Platforms Software	Event Stream Processing (ESP) Platforms	High-Productivity Application Platform as a Service (hpaPaaS)	High-Control Application Platform as a Service (hcaPaaS)
	<ul style="list-style-type: none"> ■ Application Servers ■ Cloud-Enabled Application Platforms ■ In-Memory Data Grids 			<ul style="list-style-type: none"> ■ Function PaaS (Serverless)

Source: Gartner (June 2021)

Notes for Table 8: ESP = event stream processing; hcaPaaS = high-control application platform as a service; hpaPaaS = high-productivity application platform as a service; PaaS = platform as a service

Table 9: Application Infrastructure and Middleware Market Overview (2)

Application Infrastructure and Middleware (2)				
Application Integration Suites	B2B Gateway Software (Stand-Alone)	Integration Platform as a Service (iPaaS)	Full Life Cycle API Management	Event Brokers and Messaging Infrastructure
		■ iSaaS		■ High-Performance Message Infrastructure ■ Cloud Message Broker Services

Source: Gartner (June 2021)

Notes for Table 9: API = application programming interface; B2B = business-to-business; iPaaS = integration platform as a service; iSaaS = integration software as a service

Table 10: Application Infrastructure and Middleware Market Overview (3)

(Enlarged table in Appendix)

Application Infrastructure and Middleware (3)				
MFT Suites	Business Process Management Suites	Robotic Process Automation	Digital Experience Platforms	Other AIM
■ Cloud Managed File Transfer Services	■ Cloud Business Process Management Services	■ RPA PaaS	■ Cloud Digital Experience Platform Services	■ Adapters ■ BPA Tools ■ BPM Platforms (non-BPMS) ■ BRE Software ■ IoT Platforms (AIM Components) ■ Cloud IoT Platform Services (IoT PaaS) ■ Object Request Brokers ■ EDI/B2B Value-Added Networks ■ Process Discovery ■ Process Mining ■ Miscellaneous Middleware Components

Source: Gartner (June 2021)

Notes for Table 10: AIM = application infrastructure and middleware; B2B = business-to-business; BPA = business process analysis; BPM = business process management; BPMS = business process management suite; BRE = business rule engine; EDI = electronic data interchange; IoT = Internet of Things; IoT PaaS = Internet of Things platform as a service; MFT = managed file transfer; PaaS = platform as a service; RPA = robotic process automation

The application infrastructure and middleware (AIM) market includes full life cycle API management, integration middleware, platform middleware, MFT suites, business process management (BPM)-enabling technologies, portals and digital engagement technologies.

Integration middleware is software that enables independently designed applications, software components or services to work together, by supporting data consistency, composite application and multistep process styles of integration. It includes multienterprise (B2B) integration capabilities and internal integration, as well as those products that enable existing applications to become part of a new multistep process. The Gartner market segments we consider to be integration middleware include adapters, application integration suites, B2B middleware software and message-oriented middleware (MOM).

Gartner defines platform middleware as system software that provides the runtime hosting environment for application program logic. It uses embedded or external communications middleware to help programs interact with other programs. It also provides resource management services for hosting application program logic at runtime. Platform middleware further provides interfaces with one or several forms of communications middleware (one-way messaging and request/reply). The full collection of all interfaces provided by a platform middleware product represents a programming model. Thus, platform middleware defines the style and capabilities of the applications that are developed for it. Platform middleware comes in the form of transaction processing monitors (TPMs), object request brokers (ORBs), application platform as a service (aPaaS) — including high-control aPaaS and high-productivity aPaaS — in-memory data grids (IMDGs) and enterprise application servers.

BPM-enabling technologies include BPM pure-play software, business process analysis (BPA) products, business rule engines (BREs) and business process management suites (BPMSs). We also see robotic process automation (RPA) as part of the wider AIM family of offerings.

Portals and digital engagement technologies include user-facing technologies and user-interaction-enabling middleware.

Transaction Processing Monitors

From a definitional standpoint, TPMs are part of the large family of on-premises application platforms (see [Market Guide for Application Integration Platforms](#)). However, in our Market Share reports, for a better view of the competitive landscape, we split them apart.

The earliest form of platform middleware was the mainframe TPM. Products such as IBM's CICS and IMS, and Unisys' TIP have been used on mainframes since the late 1960s. UNIX-based distributed TPMs, such as BEA Systems' Tuxedo (now owned by Oracle), NCR's Top End (acquired by BEA) and IBM's Encina, originated in the 1980s. Through the years, these products added support for distributed servers, intelligent desktop clients (rather than dumb terminals) and web browser clients, and component support using Common Object Request Broker Architecture (CORBA) or Java Platform, Enterprise Edition (Java EE) architecture.

Application Platforms Software

Application platforms include predominantly application servers but also cloud-enabled application platforms (CEAPs) and IMDGs.

Application Servers

An application server is a modern form of platform middleware. It is system software that resides between the OS on one side, the external resources (such as a DBMS, communications and internet services) on another side, and the user's applications on the third side. The function of the application server is to act as host (or container) for the user's business logic, while facilitating access to — and performance of — the business application. The application server must perform despite:

- The variable and competing traffic of client requests
- Hardware and software failures
- The distributed nature of the larger-scale applications
- The potential heterogeneity of data and processing resources required to fulfill the business requirements of the applications

A high-end online transaction processing (OLTP)-style application server delivers business applications with guaranteed levels of performance, availability and integrity. An application server also supports multiple application design patterns, according to the nature of the business application and the practices in the particular industry for which the application has been designed. It typically supports multiple programming languages and deployment platforms, although most have a particular affinity to one or two of these. Some application servers that implement standard application interfaces and protocols, such as Java EE, are entirely proprietary. At present, the proprietary application servers are typically built into OSs, packaged applications (such as portals and e-commerce solutions) or other products, and are not offered as stand-alone products. Proprietary and Java EE-compliant application servers are estimated in our Market Share and Forecast reports.

As the application server market matures, high performance becomes a stronger criterion. Thus, where vendors now incorporate extensions to application servers, such as extreme transaction processing and event-based processing capabilities, these are also included in this market segment. As the choice of where to create and deploy new applications evolves, we have seen the emergence of aPaaS offerings, which are comparable to application servers and are also included within the application server market.

Cloud-Enabled Application Platforms

CEAPs are software products that deliver, at a minimum, the core functionality of an application server. They can be extended to support multitenancy, horizontal scaling and, optionally, other capabilities — directed at the role of enabling technology for private or public application infrastructure services (also known as PaaS) or business application services (also known as SaaS).

In-Memory Data Grids

IMDGs provide a distributed, reliable, scalable and consistent in-memory data store — the data grid — that is shareable across distributed applications. These applications concurrently perform transactional and analytical operations in the low-latency data grid, thus minimizing access to high-latency, disk-based data storage. IMDGs maintain data grid consistency, availability and durability via replication and partitioning. Although they can't be classified as full application platforms, IMDGs can often host application code.

Application Platform as a Service

An aPaaS offers an application execution environment and associated development and management tools — as a cloud service. It is one of many specialized types of PaaS, although it is often erroneously seen as synonymous with all of PaaS. An aPaaS is always integrated or linked with a database system, which may or may not be also offered as a cloud database service (database PaaS [dbPaaS]) in its own right. High-productivity aPaaS and high-control aPaaS have been evolving independently toward integration.

The functional aim of an aPaaS is similar to that of an application server in the traditional on-premises software architecture — application infrastructure functionality, enriched with cloud characteristics and offered as a service.

Gartner refers to it more precisely as cloud application infrastructure services. Application platform as a service is a form of PaaS that provides a platform to support application development, deployment and execution in the cloud. It is a suite of cloud services designed to meet the prevailing application design requirements of the time and includes mobile, cloud, Internet of Things (IoT) and big data analytics innovations. In short, an aPaaS is an integrated platform that delivers end-to-end functionality for a modern application engineering project — in the form of a software service.

An aPaaS that is designed to support the enterprise style of applications and application projects (high availability, disaster recovery, security and technical support) is an enterprise aPaaS.

This market includes only companies that provide public aPaaS offerings (vendors providing aPaaS-enabling software alone are not considered).

See [Platform as a Service: Definition, Taxonomy and Vendor Landscape, 2019](#) or [Hype Cycle for Platform as a Service, 2020](#) for an expanded form of the definition of aPaaS and other forms of cloud application infrastructure services (various types of platform as a service [xPaaS]).

High-Productivity Application Platform as a Service

High-productivity aPaaS (hpaPaaS) is a foundational technology behind low-code application platform (LCAP) and is designed for projects that:

- Need ease of use, fast results, high productivity and a low cost of entry
- Can accept proprietary design models and give up much of the technology control

High-productivity aPaaS offerings encode the custom logic in metadata; use graphical, model-driven application design; and in most cases, interpret the metadata at runtime. They are popular with teams (lines of business or central IT) that need to build less technically advanced or unique applications quickly. The vendors tend to gradually add capabilities to expand their scope, including support for embedded programming or scripting and access to libraries of accelerators.

High-Control Application Platform as a Service

High-control aPaaS (hcaPaaS) is suitable for development of more advanced cloud software solutions, where the architects seek maximum control of the technology context and the organization has the necessary professional skills. Some control of underlying technology is exposed to subscribers, and programming practices follow standards through familiar languages and development tools. These platforms are popular with more technically sophisticated IT teams and those that build web-scale cloud applications. High-control aPaaS requires professional IT skills and is more often used in central IT, although some lines of business have sufficient IT expertise to build on these platforms as well.

Application Integration Suites

Formerly named “enterprise service bus (ESB) suites,” application integration suites are defined as a set of software functionality, founded on an ESB, that can support optional mediation functions, particularly for API/SOA scenarios, and also can support traditional, heterogeneous application integration projects. To be an application integration suite, a middleware subsystem must:

- Implement program-to-program communication (always supporting SOAP/HTTP and almost always supporting other protocols, such as SOAP/MOM, plain MOM and REST)
- Support other core web services standards (always including XML/SOAP and REST/JSON)
- Be capable of service discovery, binding and virtualization (transparently switching to alternative service components), and intelligent (header-based) routing
- Provide message mapping and transformation capabilities
- Support service orchestration to enable multistep process integration requirements
- Have an extensible, intermediary-based architecture so that additional features can be plugged in

- Be aware of message schemas, through the use of metadata, so that functions that require an understanding of the message contents can be supported
- Provide adapters to technology environments (such as databases, MOM and legacy application platforms) and business applications (like NetSuite; Oracle E-Business Suite [EBS] and ERP Cloud; Salesforce; SAP ECC and S/4HANA; ServiceNow; and Workday)

An application integration suite may also provide additional services, such as B2B gateway, IoT integration or RPA integration.

B2B Gateway Software

B2B gateway software (BGS) is integration middleware that is used to consolidate and centralize data and process integration and interoperability between a company's internal applications/systems and external endpoints, such as business partners or ecosystems.

BGS is a composite market that includes pure-play BGS solutions and BGS that is embedded or combined with a wide range of other IT solutions. Examples include application integration suites that support BGS features as extensions to the suite, infrastructure for API/SOA, integration brokerage services, e-invoicing software and networks, application servers, application platform suites, EDI translators, and MFT technology. B2B-enabled integration middleware is also available in collections (such as the Oracle SOA Suite and SAP Process Orchestration) that are designed to complement a vendor's packaged applications. However, to avoid double counting, in our market share studies, we consider only pure-play BGS solutions.

Integration Platform as a Service

An integration platform as a service (iPaaS) provides capabilities to enable subscribers (also called "tenants") to implement data, application, API and process integration projects spanning cloud-resident and on-premises endpoints. This is achieved by developing, deploying, executing, managing and monitoring "integration flows" (also known as "integration processes") — that is, integration applications bridging between multiple endpoints so that they can work together.

iPaaS capabilities typically include:

- Communication protocol connectors (FTP, HTTP, Advanced Messaging Queuing Protocol [AMQP], Message Queue Telemetry Transport [MQTT], Apache Kafka, Applicability Statement [AS]1/2/3/4, among others)

- Application connectors/adapters for SaaS and on-premises packaged applications and technology environments (DBMSs, MOM, event brokers, among others)
- Data formats (XML, JSON, Abstract Syntax Notation One [ASN.1], and so on)
- Data standards (ANSI X12, United Nations Electronic Data Interchange for Administration, Commerce and Transport [EDIFACT], Health Level Seven International [HL7], Society for Worldwide Interbank Financial Telecommunication [SWIFT], among others)
- Data mapping and transformation
- Data quality
- Routing and orchestration
- Integration flow development and life cycle management tools
- Integration flow operational monitoring and management
- API management
- Development tools, increasingly able to support multiple types of personas (integration specialists, ad hoc integrators and citizen integrators)

Several iPaaS providers make use of artificial intelligence (AI), ML, NLP and chatbots to facilitate and assist integration processes development, as well as to enhance their platform quality of service.

An iPaaS is typically used for cloud service integration (CSI) as well as application and data integration scenarios. Increasingly, they are also being used for B2B integration, mobile app integration (MAI), API publishing, RPA and IoT integration scenarios.

Gartner considers an iPaaS to be an “enterprise iPaaS” if it:

- Is designed to support enterprise-class integration projects (that is, projects requiring high availability, disaster recovery, security, SLAs and technical support from the provider)
- Can support several of the use cases mentioned previously

This market includes only companies that provide public iPaaS offerings. Providers that sell only iPaaS-enabling software or that provide iPaaS capabilities either embedded in other xPaaS solutions (such as aPaaS), or with SaaS applications, are not considered to be players in the enterprise iPaaS market.

Integration Software as a Service

Integration SaaS (iSaaS) offerings, also known as cloud citizen integrator services, provide integration tools and cloud-based prepackaged and configurable integration flows (“cloudstreams”) aimed at helping consumers and business users address simple application and data integration issues. The iSaaS value proposition is that the tools enable citizen integrators to perform integration tasks without support from professional developers or integration specialists.

iSaaS offerings address simple “personal” integration needs (often referred to as “automation”) that business users face every day — for example, the need to automatically create a sales lead when an inquiry email arrives. iSaaS enables any business user (or consumer), even those with minimal IT skills, to become a “citizen integrator” who can customize cloudstreams or build new integration flows.

These integration tools, which require no training to use, enable business users to quickly develop, run and manage the life cycle of simple — typically point-to-point — integration flows without support from integration specialists.

Intuitive, “low-code” or “no-code” development generally includes the ability to:

- Configure prepackaged integrations
- Map predefined endpoints (SaaS applications, cloud services, APIs, social networks, mobile apps and “things” via simple “if/then” modeling)

Full Life Cycle API Management

Full life cycle API management products support the planning, design, implementation, publication, operation, versioning and retirement of APIs. They include an API portal to help developers who use APIs to build solutions. They also include runtime management, typically provided by an API gateway that governs access to APIs, including security, and gathers analytics for use by API providers. They also provide administrative tools for defining policies and managing API life cycles, and business-related tools to support monetization and customer support.

It is important to distinguish between basic API management and full life cycle API management. Basic API management typically focuses on just the deployment and runtime aspect.

Architecturally, full life cycle API management includes a customizable API developer portal to support developer outreach and enablement. Basic API management typically provides only API gateways.

Cloud-based full life cycle API management services are useful for organizations developing APIs on cloud platforms and exposing APIs to channels (including mobile channels), while taking advantage of scale (for seasonal businesses with spikes in API traffic, for example). On-premises API management is often used by organizations that cannot deploy APIs to the cloud – for privacy reasons, for example. In discussions with users of Gartner’s client inquiry service, we often hear of requirements for hybrid architecture for full life cycle API management, with APIs deployed through cloud services but linked to on-premises systems. Full life cycle API management vendors can differentiate themselves by supporting sophisticated hybrid architectures.

API management is also available from cloud providers, as well as vendors that also provide iPaaS, some of which provide cloud-based API management.

Event Brokers and Messaging Infrastructure

An event broker is middleware software, appliance or SaaS used to transmit events between event producers and consumers in a publish-subscribe pattern. Publish-subscribe (pub-sub) pattern is now mainstream. It is an asynchronous messaging service that decouples services that produce events from services that process events. Pub-sub can be used as messaging-oriented middleware or event ingestion and delivery for streaming analytics pipelines. Pub-sub offers durable message storage and real-time message delivery with high availability and consistent performance at scale.

Additionally, messaging infrastructure technologies (part of it is traditionally referred to as “message-oriented middleware”) provides connectionless program-to-program communications services for intra-application and interapplication (that is, integration) purposes. Interactions implemented with messaging infrastructure may be fully asynchronous (one way, store and forward) or partially synchronous (immediate, one-way delivery or two-way request/reply exchanges). Messaging infrastructure strengths are in connectionless (loosely coupled) communications, store and forward (queuing), guaranteed delivery, broad platform support (run on many OSs), and in some cases, content- or subject-based addressing (for example, publish and subscribe). Unlike remote procedure calls (RPCs), messaging products also support one-to-many, many-to-one or many-to-many delivery.

Messaging products complement application servers by providing features that are missing or not well-supported through RPC and other connection-oriented communications mechanisms, such as Component Object Model+ (COM+), CORBA and, more recently, AMQP. All major Java application servers and most integration suites now include a bundled MOM service, often based on the Java Message Service (JMS) standard, but stand-alone (unembedded) messaging products are also still sold.

This segment also includes new kinds of messaging emerging from the industry, including low-latency messaging.

High-Performance Message Infrastructure

High-performance message infrastructure consists of software or appliances that provide program-to-program communication with high quality of service, including assured delivery and security. These products use innovative design concepts and in-memory computing. They support higher throughput (hundreds of thousands of messages per second), lower latency (less than 10 microseconds for local message delivery), or many orders of magnitude more message producers and consumers than traditional messaging products.

Cloud Message Broker Services

Cloud message broker services provide program-to-program communication with a variety of optional message delivery patterns and features for data integrity. Messaging is used in preference to plain HTTP and other communications technologies when:

- The message producers (senders) and consumers (receivers) run asynchronously.

- The integrity of the messages is important (for example, messages can be temporarily stored on disk to prevent them from being lost in the event of a system failure).
- The same message must be delivered to multiple consumers (generally using publish-and-subscribe messaging).

Cloud message broker services are relatively new and their usage is limited. However, they are growing faster than conventional noncloud forms of messaging. As more applications and data move to the cloud, the need for reliable, high-volume cloud messaging will continue to rise. Cloud messaging services are especially appropriate for wide-area messaging over the internet, such as for B2B or for connecting components of mobile applications and branch-office applications to a data center in the same company. They are not suited for messaging applications within one data center or one machine.

MFT Suites

MFT solutions enable organizations to manage and monitor their file transfers. MFT on-premises offerings usually comprise four discrete functionalities that organizations can deploy separately. However, organizations often deploy them as a suite. The functionalities basic to MFT are:

- **Server** — This manages all aspects of the file transfer and supports multiple communications and security protocols and mechanisms, workflow, provisioning, some transformation, automation APIs and adapters, and streaming input/output.
- **Client** — This is a subset of server technologies, mainly for integration with the MFT server. Applications (via APIs) and humans (via a GUI) use clients for collaboration, such as large file transfers using email or collaboration systems.
- **Proxy** — These technologies abstract other elements of the infrastructure, such as a proxy deployed in a demilitarized zone that conceals the true Internet Protocol (IP) addresses and ports of senders and recipients.
- **Plug-in** — This interoperates or integrates with applications, enabling them to communicate natively with MFT servers, or enabling ad hoc file transfers.

Cloud Managed File Transfer Services

Gartner bases its definition of cloud managed file transfer platform as a service (MFTPaaS) on the same functional criteria applied to on-premises MFT. These include server (including data transfer and security), client, proxy and plug-in capabilities that can be deployed separately, but are usually deployed as a suite.

The fundamental job of an MFT service is to facilitate efficient management of bulk data transfer from a source to one or more target endpoints. The source and target endpoints can be in the same enterprise or external to the enterprise.

Cloud-enabled MFT functionality can be delivered as a public cloud service, or as MFT software deployed in a public or private cloud. The software can be deployed on-premises or in the cloud using infrastructure as a service (IaaS), for example, Amazon Web Services (AWS) or Rackspace Technology. Cloud service offerings in the MFT market continue to grow, with most new offerings addressing scheduled, triggered and ad hoc file transfers.

An evolving deployment scenario is a hybrid model consisting of an on-premises MFT solution to address internal file transfers, and cloud MFT services for transferring files to and from external endpoints.

- Internal file transfer examples include application-to-application or scheduled and unscheduled file transfers.
- Cloud MFT service transfer examples include B2B integration, email attachment offload, cloud integration, scheduled and unscheduled file transfer, and file-sharing usage scenarios.

Business Process Management Suites

BPM was developed in response to the unpredictability of today's global markets. BPM views business processes as assets that can be managed and adapted in response to constant change. Strategic business processes (the ones that convey competitive differentiation to an organization) are the ones that require the most rapid and effective response to competitive threats.

The tenets of BPM as a discipline include:

- Making the business process visible (and thus explicit) to business and IT constituents through business process modeling
- Empowering business users and business analysts to manipulate a business process model to directly affect modifications in downstream implementations

- Enabling rapid iteration of processes and underlying systems for continuous process improvement

BPM is a technology-enabled discipline, which causes the confusion between the BPM discipline and BPM technologies. A number of technologies could be used for BPM, but BPMSs represent the most evolved and comprehensive approach to BPM at present. A BPMS is a complete set of integrated composition technologies for managing all aspects of processes in which business professionals and IT collaborate as peers. These aspects include people, machines, information, business rules and policies that support full process discovery, analysis, design, development, execution, monitoring and optimization cycle. A BPMS makes the business process explicit (visible and independent of its implementation), using business process models. A BPMS makes these models executable. The models are not just documentation.

A BPMS must include the following 10 component capabilities:

1. Process execution and state management engine
2. Model-driven development environment
3. Document and content interaction
4. User and group interaction
5. Basic system connectivity
6. Business event, BI and BAM support
7. Online and offline simulation and optimization
8. Business rule management
9. System management and administration
10. Process component registry/repository

BPMSs have now become the most widely adopted model-driven application infrastructure stack. These products are morphing into intelligent business process management suites (iBPMSs) as they add new features that leverage the Nexus of Forces (mobile, social, cloud and information). However, it will take at least a few years before the iBPMS is broadly adopted.

Cloud Business Process Management Services

The term “business process management platform as a service” (bpmPaaS) refers to a basic BPM platform, a BPMS or an iBPMS delivered via PaaS. IT developers or citizen developers use basic BPM platforms to develop and compose “code-free” applications to automate work. Business outcome owners and IT use BPMSs to accelerate process change and improve business outcomes. Business transformation leaders and business outcome owners use iBPMSs to radically reinvent how the business operates with its value chain partners. To qualify as a bpmPaaS, a BPM platform must be available as a one-to-many service and include at least one of the following BPM runtime capabilities — flow management, rule management, optimization and simulation, or BAM.

Robotic Process Automation

RPA tools perform “if, then, else” statements on structured data, typically using a combination of UI interactions, or by connecting to APIs to drive client servers, mainframes or HTML code. An RPA tool operates by mapping a process in the RPA tool language for the software “robot” to follow, with runtime allocated to execute the script by a control dashboard.

RPA PaaS

RPA PaaS is a set of public cloud-hosted services to create and execute RPA scripts against customer applications. The service consists of web-based RPA development environments, orchestrators and a performance dashboard. The orchestrator interacts with lightweight agents installed in the client environment that execute “bots.” Unlike RPA SaaS options that offer a ready to use business capability service, RPA PaaS is intended for developers to create a new business function/service.

Digital Experience Platforms

Gartner defines a digital experience platform (DXP) as “an integrated set of core technologies that support the composition, management, delivery and optimization of contextualized digital experiences.” DXPs place a high degree of emphasis on interoperability and cross-channel continuity across the entire customer journey.

The purpose of a DXP is to be the central technological foundation for the digital customer experience aspect of a digital business.

DXPs act as an interaction and experience layer in a complex, extensive and interconnected technology landscape. Beyond simple websites and mobile apps, organizations need to deliver, via APIs, highly contextualized digital experiences to an increasing variety of modalities (chatbots, digital assistants, voice assistants and others), channels and devices (web, mobile web, mobile apps, kiosks, IoT/smart devices, and more) across the customer journey. The DXP software market overlaps with other adjacent application technologies. These include marketing automation, personalization, digital commerce, customer communications management, WCM and portals. (For more details, see [Defining the Digital Experience Platform](#).)

Cloud Digital Experience Platform Services

With DXPs being the main technological driver behind CX initiatives, application leaders responsible for DXPs are under pressure to provide an agile and scalable infrastructure and empower their business partners to innovate faster. A cloud-first approach prevails because it gives organizations the advantage of a faster pace of innovation, greater scalability and agility. (For more details, see [Platform as a Service: Definition, Taxonomy and Vendor Landscape, 2019](#).)

Event Stream Processing Platforms

Event stream processing (ESP) platforms (also known as “event stream processors”) are software systems that perform real-time or near-real-time calculations on event data “in motion.” The input is one or more event streams containing data about customer orders, insurance claims, bank deposits/withdrawals, tweets, Facebook postings, emails, financial or other markets, or sensor data from physical assets such as vehicles, mobile devices or machines. The platforms process the input data as it arrives (hence “in motion”), before optionally storing it in some persistent store. They retain a relatively small working set of stream data in memory, just long enough to perform calculations on a set of recent data for the duration of a time window. (There is a [Market Guide for Event Stream Processing](#).)

Other AIM

Other AIM is a miscellaneous subsegment. It includes technologies that are mature commodities (such as adapters and ORBs), in their infancy, or currently relatively small in revenue size (such as BRE software, business process modeling tools and BPA tools). It also includes technologies that are close to segments we track but that do not yet fulfill the requirements to be classified within those segments. An example is BPM pure-play software that includes products that do not meet the full characteristics of a BPMS.

Adapters

Adapters are small, focused programs that expose functionality and/or data in a legacy application. Our use of this term includes not only the programs, but also the framework for designing and developing adapter programs. Adapters can be deceptively complex, with “thick” adapters performing a variety of functions that include recognizing events, collecting and transforming data, and exchanging data with platform, integration suite or other middleware. However, “thin” adapters may only “wrap” a native application interface, exposing another more standard version for application access. Adapters can also handle exception conditions, and they can often dynamically (or with minor reconfiguration) accommodate new revisions of source or target applications.

Adapters are often sold in conjunction with integration middleware products, such as ESBs, integration suites or portal servers, or are offered as a stand-alone product, such as an adapter suite. Among the different adapters, high-level categories include technical and application adapters.

A comprehensive suite should include adapters for:

- Common technologies, such as Component Object Model (COM), Jakarta Enterprise Beans (formerly Enterprise JavaBeans) and web services
- Industry protocols, such as EDI, SWIFT and RosettaNet
- Common applications, such as SAP or Oracle’s PeopleSoft
- Proprietary applications, such as an adapter development kit

BPA Tools

These tools are primarily intended for use by business end users looking to document, analyze and streamline complex processes, thereby improving productivity, increasing quality, and becoming more agile and effective. These tools also support the roles of business process architect and business process analyst, and enable them to better understand business processes, events, workflows and data, using proven modeling techniques. BPA tools permit users to:

- Diagram their processes, noting (generally abstracted) rules or specifications to promote understanding
- Validate this information using standard methodologies and best practices enabled by the software
- Automate the models, ideally, into deployable applications that leverage their analytical efforts and comply with the business process rules

BPA tools feature the following functionality:

- Business model drawing and development
- Ease of use in operation, development and administration
- Business model analysis
- Integration and automation
- Multiuser support/versioning and extensibility
- Methodology and use
- Performance and scalability
- Vertical-industry and horizontal cross-industry template support

BPM Platforms

BPM platforms describe tools that deliver an application-independent approach to coordinating business. BPM platforms provide a set of services and tools for explicit process management (that is, process analysis, definition, execution, monitoring and administration), including support for human- and application-level interaction. BPM platforms include commercially available software products that have all these features:

- Process orchestration engine

- Modeling environment
- Human-to-human workflow
- Monitoring and analysis capabilities
- Offline simulation
- System-to-system integration
- Business process performance reporting

Only general-purpose, cross-industry BPM platforms are included in this category. There are many vertical-industry-specific BPM platform products that are not covered here.

BRE Software

A BRE is a specific collection of design-time and runtime software that allows an enterprise to explicitly define, analyze, execute, audit and maintain a wide variety of business logic, collectively referred to as “rules.” A BRE allows IT and/or business staff to define rules using decision trees, decision tables, pseudo-natural language, programming like code or other representation techniques. Unlike traditional AD approaches, a BRE isolates the rule representation from the executing business logic — providing for explicit rule management. A BRE provides features to analyze rules for rule conflicts, rule consistency and other quality issues. A BRE allows auditing of the rule execution path and firing order, and it provides a rule repository and related features to maintain and enhance the rule base. A BRE may simply provide rule externalization capabilities (separating rules from programming code), or it may provide higher-level rule-processing capabilities, such as inferencing (forward chaining, goal-directed backward chaining), case-based reasoning and advanced heuristics. Many BRE vendors are increasing their business rule management technologies and ecosystems, and are creating comprehensive business rule management systems that add capabilities to the basic BRE technology.

Only general-purpose, cross-industry BRE software is included in this category. There are many vertical-industry-specific BRE software products that are not covered here.

IoT Platforms (AIM Components)

IoT platforms are a set of integrated software capabilities that span efforts to improve asset management decision making, as well as operational visibility and control for plants, depots, infrastructure and equipment within asset-intensive industries. These efforts also occur within related operating environments of those industries. The IoT platform may be consumed as a technology suite or as an open and general-purpose application platform, or both in combination. The platform is engineered to support the requirements of safety, security and mission-criticality associated with industrial assets and their operating environments. The IoT platform software that resides on devices — such as controllers, routers, access points, gateways and edge computing systems — is considered part of a distributed IoT platform.

Cloud IoT Platform Services

An Internet of Things platform as a service (IoT PaaS) is a cloud service that facilitates operations involving IoT endpoints (sensors, devices, multidevice systems and fleets of systems), cloud services and enterprise resources. The platform ingests and monitors IoT event streams, enables specialized analysis and application development, engages back-end IT systems, and may help control the endpoints to support IoT solutions.

Object Request Brokers

ORBs are an enriched middleware platform — compared to their predecessors, RPC middleware — that include program activation, which most RPCs did not offer. Full-featured CORBA ORBs are transactional platforms, with a special affinity for the object-oriented programming model, including the activation and communications services that are particularly geared to the object-oriented software model. ORB vendors added transaction management, security and other features to their ORBs to enable demanding production applications. Object Management Group (OMG) CORBA emerged as the widely shared standard programming model for ORBs.

EDI/B2B Value-Added Networks

This technology has existed for more than 20 years and is associated with traditional e-commerce (supply chain integration) projects. Providers of e-commerce platforms were generally called value-added networks (VANs), trading networks, internet VANs and so forth. However, in recent years, traditional EDI vendors have evolved, and new vendors have introduced new types of integration platforms to address various forms of e-commerce.

IT providers have labeled their various offerings as VANs, integration brokerages, transaction delivery networks, web services networks, business process networks, business integration networks, business process hubs, integration service providers, marketplaces, EDI SaaS and so on. Nearly 100 IT services providers worldwide offer some form of integration platform, but other than that point of commonality, they are exceptionally diverse in their overall portfolios of IT services and industries served.

Process Mining (Task Mining)

Process mining is designed to discover, monitor and improve real processes (specifically, not assumed processes) by extracting knowledge from event logs readily available in today's information systems. Process mining includes automated process discovery (like extracting process models from an event log); conformance checking (namely, monitoring deviations by comparing model and log); social network/organizational mining; automated construction of simulation models; model extension; model repair; case prediction; and history-based recommendations. (See [Market Guide for Process Mining](#).)

Process Discovery

Process discovery is one of the main types of process mining and it is related to business process management. It refers to a set of techniques that construct (manually or automatically) a representation of an organization's current business processes and its major process variations. These techniques use evidence found in the existing documentation, methodologies and technology that run business processes within an organization.

Miscellaneous Middleware Components

Other categories of middleware, not directly covered in our market research, include:

- **RPCs** — Communications middleware products that provide synchronous, request/reply communications via a remote procedure call.
- **Data management middleware** — Products that enable programs to read from and write to databases or files on other computers. Open database connectivity drivers, database gateways, products for remote file access, and other products oriented toward providing communications of queries and data to and from a DBMS are examples of data management middleware.
- **Web-to-host middleware** — Products that facilitate the support of HTML or Java-based clients from host-based applications.

- **Componentware** — Reusable business objects, application templates, models and technical components.
- **Miscellaneous middleware components** — Screen scrapers, integration servers, transformation engines, enterprise information integration tools and transaction delivery networks.

In addition, any form of PaaS pertaining to AIM technologies — not already counted under any specific AIM segment — is not directly covered in our market research.

Data Management Software (Excluding DBMS)

Market Analysts: Sharat Menon and Alan Dayley

See Table 11 for an overview.

Table 11: Data Management Software (Excluding DBMS) Overview

Data Management Software (Excluding DBMS)				
Data Integration Software	Data Quality Software	Master Data Management Software	Metadata Management Software	Other Data Integration Software

Source: Gartner (June 2021)

Notes for Table 11: DBMS = database management system

Data Integration Software

The discipline of data integration comprises the practices, architectural techniques and tools that ingest, transform, combine and provision data across the spectrum of information types in the enterprise and beyond. Its aim is to meet the data consumption requirements of all applications and business processes.

The most recent changes in the market are the:

- Increased demand for data virtualization

- Growing use of data integration tools to combine “data lakes” with existing integration solutions
- Overall expectation that data integration will become cloud- and on-premises-agnostic

The data integration tool market comprises vendors that offer software products to enable the construction and implementation of data access and data delivery infrastructure for a variety of data integration scenarios, including:

- **Data acquisition for BI, analytics and data warehousing** — A data integration tool extracts data from operational systems, transforms and merges that data, and delivers it to integrated data structures for analytics purposes. The variety of data and context for analytics is expanding as emergent environments increasingly become part of the information infrastructure. These emergent environments include nonrelational and Apache Hadoop distributions for supporting big data, in-memory DBMSs, logical data warehouse architectures and end-user capability to integrate data (as part of data preparation). With the increased demand to integrate machine data and support IoT needs for analytics, the data integration market is heating up.
- **Sourcing and delivery of master data in support of application data management and master data management (MDM)** — A data integration tool enables the connectivity and integration of the data representing critical business entities, such as customers, products and employees. Data integration tools can be used to build the data access and synchronization processes to support MDM initiatives.
- **Data consistency between operational applications** — Data integration tools provide the ability to ensure database-level consistency across applications. This is both on an internal and an interenterprise basis (for example, involving data structures for SaaS applications or cloud-resident data sources), and in a bidirectional or unidirectional manner. IoT is specifically exerting influence and pressure here. Data consistency has become critical with new functionality in DBMS offerings — hinting that the battle for data integration is heating up to include traditional data management vendors.
- **Interenterprise data sharing** — Organizations are increasingly required to provide data to, and receive data from, external trading partners (customers, suppliers, business partners and others). Data integration tools are relevant in addressing these challenges, which often consist of the same types of data access, transformation and movement components found in other common use cases.

- **Populating and managing data in a data lake** — A data lake is an emerging concept. It is where data is continuously collected and stored:
 - In a semantically consistent approach similar to a traditional DBMS
 - With an expectation that data processing efforts will refine the semantics of a nontraditional DBMS (such as nonrelational data stores) to support data usage:
 - The need for integrating nonrelational structures and distributing computing workloads to parallelized processes (such as in Apache Hadoop and alternative NoSQL repositories) elevates data integration challenges. At the same time, it also provides opportunities to assist in the application of schemas at data read time (if needed), and to deliver data to business users, processes or applications, or to use data iteratively. In addition, the differing structure of IoT or machine data is introducing new integration needs.
- **Data migration** — Previously considered a data integration style in its own right, data migration is more of a task that can be done with a variety of tools or techniques. The primary feature of data migration is moving data to a new platform or to an update of an existing data management platform. It can also include moving data from one application to a new application or to an upgraded version of an application.
- **Support for governance and management of data assets** — Increasingly, data integration tools are expected to collect audit and monitoring information regarding the deployed data integration services and processes in the organization. This ranges from use cases for simple reporting and manual analysis to the inclusion of recommendations and even automated performance optimization. While primarily focused on management tasks, the ability to profile new data assets and recognize their similar nature and use cases as compared to other data currently integrated, is growing in importance. Small devices that roam and attach to data portals will also become prevalent. The requirement for metadata capabilities will become the center of all integration approaches.

The usage of data integration tools may display characteristics not unique to one of these individual scenarios. Technologies in this market are required to execute many core functions of data integration, which can apply to any of the previous scenarios. Examples of resulting characteristics include the following:

- Interoperating with application integration technology in a single solution architecture to, for instance, expose ETL processes that extract data from sources as a service to be provisioned via an ESB. Increasingly, there is a demand for analyzing and integrating data during “business moments” when events demand an in-process operational change based on data-driven decisions.
- Enabling data services as an architectural technique in an SOA context. Rather than the use of data integration as such, this represents an emerging trend for data integration capabilities to play a role and to be implemented within software-defined architecture for application services.
- Integrating a combination of data residing on-premises and in SaaS applications and other cloud-based data stores and services, in order to fulfill requirements such as cloud service integration. Organizations are also seeking the capability for pivoting between cloud and on-premises — what Gartner refers to as a hybrid integration platform (HIP). Today, several data integration tool vendors provide cloud-based iPaaS offerings. (Note that these offerings are tracked not as part of the data integration tool market, but instead in the iPaaS segment within the AIM market.)
- Connecting to, enabling the delivery of data to, and accessing data from platforms typically associated with big data initiatives, such as Apache Hadoop, nonrelational and cloud-based data stores. These platforms provide opportunities for distributing data integration workloads to external parallelized processes. The emerging concept of a data lake, where data is continuously collected and stored in a lightly structured NoSQL repository, poses data integration challenges.

Data Quality Software

Data quality is a discipline focused on ensuring that the condition of data is fit for use in existing business operations and emerging digital business scenarios. The data quality tool market continues to innovate, fueled by a desire for trusted data assets, data governance and digital transformation.

As a discipline, data quality comprises much more than technology. It also includes:

- Program management
- Roles and organizational structures
- Business use cases and workflows

- Processes for monitoring, measuring and remediating data quality issues
- Links to broader data initiatives, such as data governance and MDM, via data-quality-specific policies

Given the scale and complexity of the data landscape across organizations of all sizes and in all industries, solutions to help automate key elements of the discipline continue to attract more interest and to grow in value. As such, the data quality tool market continues to show substantial growth, while exhibiting innovation and change.

Gartner's definition of the market for data quality solutions focuses on innovative technologies and approaches intended to meet the data quality needs of end-user organizations in the next 12 to 18 months. As digital business requires innovations in data quality solutions, vendors are competing fiercely by enhancing existing capabilities and creating new capabilities in eight key areas:

1. Audience
2. Governance
3. Data diversity
4. Latency
5. Analytics
6. Intelligence
7. Deployment
8. Pricing

The data quality tool market comprises vendors that offer software products to address the core functional requirements of the discipline, which are:

- **Connectivity** — Capability to access and apply data quality rules to a wide range of data sources, including internal and external, on-premises and cloud, and structured and unstructured data sources.

- **Data profiling, measurement and visualization** — Data analysis capabilities that give business and IT users (especially those supporting business users) insights into the quality of data and help them identify and understand data quality issues.
- **Monitoring** — Capability to assist with the ongoing understanding and assurance of data quality through monitoring of, and alerting to, possible data quality issues.
- **Parsing** — Built-in capabilities for decomposing data into its component parts.
- **Standardization and cleaning** — Capabilities for applying government, industry or local standards, business rules or knowledge base to modify data for specific formats, values and layouts.
- **Matching, linking and merging** — Capabilities for matching, linking and merging related data entries within or across datasets, using a variety of techniques, such as rules, algorithms, metadata and machine learning.
- **Multidomain support** — Capabilities for specific data subject areas, such as customer, product, asset and location.
- **Address validation/geocoding support** — Capability to support location-related data standardization and cleansing, and completion for partial data in real time or batch process.
- **Data curation and enrichment** — Capability to integrate externally sourced data in order to improve completeness and add value.
- **Business rule development and implementation** — Capability to create, deploy and manage business rules that can then be called within the solution or by third-party applications for data validation purposes.
- **Issue resolution and workflow** — Process workflow and user interface that enables business users to identify, quarantine, assign, escalate, resolve and monitor data quality issues.
- **Metadata management** — Capability to capture, reconcile and interoperate metadata relating to the data quality process.
- **DevOps environment** — Capability to facilitate configuration of data quality operations.
- **Deployment environment** — Styles of deployment and hardware, operating system and maintenance options for deploying data quality operations.

- **Architecture and integration** — Commonality, consistency and interoperability among various components of the data quality solution and third-party tools.
- **Usability** — Suitability of the solution to engage and support the various roles (especially business roles) required by a data quality initiative.

Master Data Management

Master data is the consistent set of identifiers and extended attributes that describe the core entities of the enterprise and that are used across multiple business processes. Core entities include parties (for example, customers, prospects, people, citizens, employees, vendors, suppliers and trading partners), places (including locations, offices, regional alignments and geographies) and things (such as accounts, assets, policies, products and services). Groupings of master data include organizational hierarchies, sales territories, product roll-ups, pricing lists, customer segmentations and preferred suppliers.

MDM is a technology-enabled business discipline in which business and IT organizations work together to ensure the uniformity, accuracy, stewardship, semantic consistency and accountability of the enterprise's official, shared master data assets.

Over the past 10 years and through thousands of interactions, Gartner has observed many MDM implementations in almost every industry and region around the world.

Implementing firms range from large, distributed and highly heterogeneous to midsize, local and mostly homogeneous uses. Over this time period, and with this level of exposure, Gartner has identified five primary vectors of MDM complexity:

1. **Use cases** — A use case is the primary area of the business in which the discipline is focused.
2. **Industry** — Each industry attracts a slew of nuanced differences.
3. **Domain** — Each category, even individual domains, attracts its own set of nuanced differences.
4. **Organization** — Each organization represents political, social and structural barriers dictating or inhibiting MDM.

5. **Implementation style** — This is the degree to which master data is physically instantiated across the business, which is often determined based on decisions made in reference to the other four vectors. Yet any implementation style also brings its own set of complexities to the discipline.

These five vectors are the main drivers of complexity within MDM. However, there are other related disciplines and initiatives, related to MDM, that yield additional intricacies but also complementary value to users. These include application data management (for extended application-specific attributes for common master data domains), as well as “360-degree view” implementations of domains (such as customer or product) that add other attributes, as well as relationship data — and even content.

Metadata Management Software

Metadata management is a core aspect of an organization’s ability to manage its data and information assets. The term “metadata” describes the various facets of an information asset that can improve its usability throughout its life cycle. Metadata and its uses go far beyond technical matters. Metadata is used as a reference for business-oriented and technical projects, and lays the foundations for describing, inventorying and understanding data for multiple use cases. Use-case examples include data governance, security and risk, data analysis and data value.

The market for metadata management software is complex because these solutions are not all identical in scope or capability. Vendors include companies with one or more of the following functional capabilities in their stand-alone metadata management products (not all vendors offer all these capabilities, and not all vendor solutions offer these capabilities in one product):

- **Metadata repositories** — Used to document and manage metadata, and to perform analysis using metadata. Organizations can also use repositories to publish information about reusable assets, which enables users to browse metadata during life cycle activities such as design, testing and release management.
- **Business glossary** — A repository used to communicate and govern an enterprise’s business terms, along with the associated definitions and the relationships between those terms.
- **Data lineage** — Specifies the origins of data and where it moves over time. Data lineage also describes what happens to data as it goes through diverse systems and processes. Data lineage can help with analyzing how information is used and tracking the flow of information across the enterprise, serving various purposes.

- **Impact analysis** — Conveys extensive details about the dependencies of information or the impact of a change propagated from a data source.
- **Rule management** — Automates the enforcement of business rules that are tied to data elements and associated metadata. This capability supports dedicated interfaces for the creation of — and the order of execution and links with — information stewardship for effective governance.
- **Semantic frameworks** — Include support for taxonomies; entity relationship (ER) models; and ontology and modeling languages such as the Resource Description Framework (RDF), the Web Ontology Language (OWL) and the Unified Modeling Language (UML).
- **Metadata connectors for ingestion and translation** — Using techniques or bridges for various data sources, such as:
 - Extraction, transformation and loading (ETL), application integration, data integration, search.
 - Business intelligence (BI) and reporting tools.
 - Modeling tools.
 - Database management system (DBMS) catalogs.
 - ERP and other applications.
 - XML formats.
 - Hardware and network log files.
 - Microsoft Excel spreadsheets and Word documents.
 - PDF documents.
 - Business metadata.
 - Custom.
- **System metadata administration and operations runtime metadata** — from networks, servers, communications nets, telemetry and other hardware specification and operations data.

Database Management Systems

Market Analysts: Sharat Menon

See Table 12 for an overview.

Table 12: Database Management Systems

Database Management Systems		
Nonrelational DBMS	Prerelational-era DBMS	RDBMS

Source: Gartner (June 2021)

Notes for Table 12: DBMS = database management system; RDBMS = relational database management system

A DBMS is a complete software system used to define, create, manage, update and query a database. A database is an organized collection of data that may be in multiple formats and may be stored in some form of storage medium (which can include hard-disk drives, flash memory, solid-state drives and/or DRAM). Additionally, DBMSs provide interfaces to independent programs and tools that both support and govern the performance of a variety of concurrent workload types. There is no presupposition that DBMSs must support the relational model or that they must support the full set of possible data types in use today. Further, there is no restriction that the DBMS must be a commercial product. Commercially supported open-source DBMS products are included in this market.

Within the DBMS market share and forecast, we have segmented products into three categories:

- 1. RDBMS
- 2. Nonrelational DBMS (formerly called semistructured DBMS)
- 3. Prerelational-era DBMS

Products included in the RDBMS segment include all products that meet the definition and conform to the majority of the current ANSI SQL standards for RDBMSs, including those that brand themselves as NewSQL or extended relational technologies. This also includes RDBMS products that have incorporated in-memory processing for either analytical, operational or both kinds of use cases. It also includes those that have expanded to allow multiple schemas beyond relational, which Gartner refers to as multimodal DBMS (in this case, relational multimodel).

Nonrelational DBMS includes products that were developed after the 1990s that are not based on relational theory and may/do not support the current ANSI SQL standard. These products vary in the data model(s) they support and include all categories of products branded as NoSQL, as well as Apache Hadoop-based DBMS. Note that Gartner no longer uses the term “NoSQL” as many of these products do support some level of SQL. Therefore, Gartner has dropped the NoSQL term in favor of “nonrelational” for these product offerings. Their data models do not conform with the formal structure of data models associated with relational databases or other forms of data tables. Yet nonetheless, they contain tags or other markers to separate semantic elements and enforce hierarchies of records and fields within the data. Therefore, it is also known as self-documenting structure. Note that many of these products are now multimodel as well.

Prerelational-era DBMS includes products that were developed before relational theory became widely used, including products based on a hierarchical structure or a navigational (also known as network or CODASYL) structure.

The bulk of DBMS use cases fall into two broad categories:

1. **Data management solution for analytics (DMSA)** — A data management solution for analytics is defined as a complete software system that supports and manages data in one or many file management systems (most commonly a database or multiple databases). It also includes specific optimization strategies designed for supporting analytical processing. This includes — but is not limited to — relational processing, nonrelational processing (such as graph processing), and machine learning or programming languages, such as Python or R. Data is not necessarily stored in a relational structure and can use multiple models (relational, document, key-value, text, graph, geospatial and others). A DBMS solution qualifying as a DMSA is a system for storing, accessing, processing and delivering data intended for one or more of the four primary use cases Gartner identifies that support analytics:
 - **Enterprise data warehouse** — This use case involves managing historical data coming from various structured sources. Data is mainly loaded through bulk and batch loading. The traditional data warehouse use case can manage large volumes of data and is primarily used for standard reporting and dashboarding. To a lesser extent, it is used for free-form querying and mining, or operational queries. It requires high capabilities for system availability and administration and management, given the mixed workload capabilities for queries and user skills breakdown.
 - **Operational data warehouse** — This use case manages structured data that is loaded continuously in support of embedded analytics in applications, real-time data warehousing and operational data stores. This use case primarily supports reporting and automated queries to support operational needs, and it will require high-availability and disaster recovery capabilities to meet operational needs. Managing different types of users or workloads, such as ad hoc querying and mining, will be of less importance as the major driver is to meet operational excellence.
 - **Logical data warehouse (including data lakes)** — This use case manages data variety and volume of data for both structured and other content data types. Besides structured data coming from transactional applications, this use case includes other content data types, such as machine data, text documents, images and videos. Since additional content types can drive large data volumes, managing large volumes is an important criterion. A logical data warehouse is also required to meet diverse query capabilities and support diverse user skills. This use case supports queries reaching into other sources than the data warehouse DBMS alone.

- **Context-independent data warehouse** — This declares new data values, variants of data form and new relationships. It supports search, graph and other advanced capabilities for discovering new information models. This use case is primarily used for free-form queries to support forecasting, predictive modeling or other mining styles, as well as queries supporting multiple data types and sources. It has no operational requirements and favors advanced users, such as data scientists or business analysts, resulting in free-form queries across potentially multiple data types.
2. **Operational DBMS (OPDBMS)** — This is used to process, store and manage data for a variety of applications. OPDBMSs must include functionality to support backup and recovery and have some form of transaction durability — although the atomicity, consistency, isolation and durability (ACID) model is not a requirement. OPDBMSs may support multiple delivery models, such as stand-alone DBMS software, certified configurations, cloud (public and private) images or versions, and database appliances.

IT Operations Management Software

Market Analyst: Laurie Wurster

See Table 13 for an overview.

Table 13: IT Operations Management Software Market Overview

(Enlarged table in Appendix)

IT Operations Management Software				
Delivery Automation	Experience Management	Performance Analysis	ITOM Mainframe Tools	Other ITOM
<ul style="list-style-type: none"> ■ Application Release Orchestration ■ Cloud Management Platforms ■ Cloud Migration Tools ■ Container Management ■ Continuous Configuration Automation ■ Continuous Delivery ■ DevOps Toolchain Orchestration ■ Heuristic I&O Automation ■ Hybrid Cloud Computing ■ IT Process Automation ■ IT Service Orchestration ■ IT Workload Automation ■ Network Automation ■ Server Automation ■ Unified Communications Monitoring Tools ■ Other Automation Tools 	<ul style="list-style-type: none"> ■ I&O Business Value Dashboards ■ IT Financial Management ■ IT Service Management ■ Software Asset Management ■ IT Asset Management 	<ul style="list-style-type: none"> ■ Artificial Intelligence for Operations ■ Application Performance Monitoring Suites ■ Capacity Planning and Management Tools ■ Digital Experience Monitoring ■ Dynamic Optimization Technology ■ IT Event Correlation and Analysis Tools ■ IT Infrastructure Monitoring ■ Network Fault Management ■ Network Performance Monitoring and Diagnostics ■ Wireless Network Monitoring Tools ■ Virtual Desktop Infrastructure Monitoring ■ Other Monitoring Tools 		

Source: Gartner (June 2021)

Notes for Table 13: I&O = infrastructure and operations; ITOM = IT operations management

IT operations management (ITOM) software is intended to represent all the tools needed to manage the provisioning, capacity, performance and availability of computing, networking and application resources — as well as the overall quality, efficiency and experience of their delivery. Gartner divides the ITOM market into three minisuite categories — delivery automation, experience management and performance analysis — in addition to a roll-up of mainframe and other nonspecified ITOM tools.

Delivery Automation

Automation describes many different types of software-based technologies that are designed to automate, supplement or augment manual processes. Therefore, these tools reduce labor costs or increase business value delivered, or both, and they improve process (and task) execution reliability, repeatability and efficiency. The result is improved speed and reduced risk. Most automation tools today specialize in specific areas, but some multifunctional tools have become widespread. Automation tools often provide an active capability that either makes a change to a system (hardware or software) or provides a mechanism to integrate across (disparate) systems and management tools to execute a single or multiple process workflows.

Application Release Orchestration

Application release orchestration (ARO) tools provide a combination of deployment automation, pipeline and environment management, and release orchestration capabilities to simultaneously improve the quality, velocity and governance of application releases. ARO tools enable enterprises to scale release activities across multiple, diverse and multigenerational teams (like DevOps), as well as technologies, development methodologies (such as agile, among others), and delivery patterns (for example, continuous), also pipelines, processes and their supporting toolchains.

Cloud Management Platforms

Cloud management platforms (CMPs) enable organizations to manage multicloud (such as private and public cloud) services and resources. This includes providing governance, life cycle management, brokering and automation for managed cloud resources across most of seven functional areas. These include:

1. Provisioning and orchestration
2. Service request management
3. Inventory and classification
4. Monitoring and analytics
5. Cost management and resource optimization
6. Cloud migration, backup and disaster recovery
7. Identity, security and compliance

Owing to the market dominance of AWS and Microsoft Azure and the ongoing need for private cloud and cloud-inspired deployments (virtualized VMware environments, OpenStack, among others), the tooling must support at least these environments.

Cloud Migration Tools

Cloud migration is the process of planning and executing the movement of applications or workloads from on-premises infrastructure to external cloud services, or between different external cloud services.

Container Management

Container management software covers on-premises and/or hybrid systems that provide the automation and abstraction of containers along with infrastructure capabilities. Deploying containers at scale requires capabilities that enable agility for application developers, while also providing reliability and simplicity for infrastructure and operations (I&O) teams. Container management software systems provide not only abstraction of infrastructure details and application life cycle pipeline enablement for developers, but also an underlying infrastructure foundation that scales and is secured. In many cases, these solutions are allowing enterprises to use containers as a replacement for application servers.

Continuous Configuration Automation

Continuous configuration automation (CCA) tools enable infrastructure (data center and cloud) administrators and developers to automate the deployment and configuration of settings and software programmatically. They support the description of configuration states and settings, as well as the deployment of software binaries and configuration data. Most CCA tools are open-source and commercial offerings. Commercial CCA tools have vendor support, role-based administration and more advanced management capabilities than the open-source versions.

Continuous Delivery

The analog to continuous integration (CI), continuous delivery (CD) enables DevOps teams to reliably release application and infrastructure code at any time through the creation of an automated pipeline. It is a key capability of a DevOps initiative, enabled by a DevOps toolchain. It involves the combined use of CI, automated testing, deployment orchestration and execution (often performed by application release orchestration), and other tools to reduce code-to-production cycle times.

DevOps Toolchain Orchestration

DevOps toolchain orchestration refers to the concept of providing the ability to manage the personnel and tool activities that support a DevOps pipeline. This includes the ability to:

- Assign, collaborate, monitor, track and report on activities
- Identify delays and bottlenecks in the delivery
- Integrate DevOps tools
- Automate pipeline activities — from code planning to live production

Heuristic I&O Automation

Heuristic I&O automation involves collecting, analyzing and applying human- and machine-based learning and intelligence to tailor specific automated actions to unique situations and dependencies. Heuristic automation is knowledge- and analytics-driven, where most automations use a deterministic, predefined workflow-driven approach.

Hybrid Cloud Computing

Hybrid cloud computing is the coordination of cloud services across public, private and community cloud service providers to create another cloud service, which is how it differs from multicloud computing. A hybrid cloud computing service is automated, scalable and elastic; has self-service interfaces; and is delivered as a shared service using internet technologies. Hybrid cloud computing needs integration between the internal and two or more external environments at the data, process, management or security layers.

IT Process Automation

IT process automation (ITPA) tools automate IT operations processes across traditional, virtual and public cloud resources, integrating and orchestrating multiple IT operations activities. ITPA tools can focus on a specific IT process (like server provisioning), replacing or augmenting scripts and manual processes, or they can be applied to processes that span different operational or application domains.

IT Service Orchestration

IT service orchestration (ITSO) is the organization, sequencing and management of workflow activities and scripts across multiple functional pockets of IT/I&O automation to help visualize, control and simplify the delivery of IT services. ITSO technologies and practices leverage automation skills and capabilities across multiple technologies and teams. ITSO includes intelligence-based decision making to orchestrate provisioning of increasingly complex business services.

IT Workload Automation

Workload automation tools manage and automate the scheduling and movement of workloads and infrastructure tasks – within and between applications, and across mainframes and distributed, virtual and cloud environments. In addition, they manage mixed workloads based on policies in which resources are assigned, or deassigned, in an automated fashion to meet service-level objectives.

Network Automation

Gartner defines the network automation market as tools that automate the visibility, troubleshooting, reporting and maintenance of virtual and physical network device configurations, supporting opportunities to lower costs, reduce human error and improve compliance with configuration policies. Gartner has broadly categorized network automation into the following four distinct subsegments:

1. **Intent-based networking (IBN)** – The mathematical validation that business intent and network configurations are in sync.
2. **Policy-based automation (PBA)** – Abstraction away from a device-configuration-centric view and replacing it with a centralized policy control flow, particularly in scenarios concerning software-defined networking (SDN), software-defined WAN and Ethernet fabric technologies.
3. **Orchestration** – Programmatic control of network elements interfacing with either device command line interface (CLI) environments and/or open standards APIs, often incorporating principles based on a DevOps philosophy.
4. **Network configuration and change management (NCCM)** – The setup and configuration, patching, rollout, rollback, resource use, and change history of the physical network infrastructure, often in comparison with the “gold standard” for the device in question.

Server Automation

Server automation tools manage the software configuration life cycle for physical and virtual servers.

This category is composed of the following four subcategories:

1. **Server provisioning** — This step in the server life cycle automates the installation of the server OS and initial configuration (such as settings and applications).
2. **Server configuration automation** — These tools focus on the deployment and configuration of settings and software for physical and virtual servers. They enable the ability to customize server settings and can deploy software binaries.
3. **Patch management** — Patch management tools are used predominantly by IT administrators (like client, server, database and middleware administrators) to automate the deployment of OS and software patches. Patch management tools provide patch content, discovery, targeting and scheduling, deployment, and reporting.
4. **Configuration auditing** — Configuration auditing tools provide change detection and configuration assessment across servers, applications, databases and networking devices, as well as internal and public cloud infrastructures. Company-specific policies or industry-recognized security configuration assessment templates (for example, National Institute of Standards and Technology [NIST]) maintain the fidelity of the system for auditing, hardening or improved availability. Some can remediate to a desired state. Others work with configuration management tools for remediation.

Unified Communications Monitoring Tools

Unified communications (UC) monitoring tools collect and analyze information from vendor-supplied data sources, including call detail records (CDRs), quality metrics and overall system data. Some tools use standard APIs, FTP and file copy, or they can extract data from UC and VoIP vendor databases and repositories. Advanced tools have the ability to collect packet data, decode voice and video codecs, and employ synthetic call testing.

Other Automation Tools

Other automation tools that are no longer actively covered but with revenue remaining in this category include IT service dependency mapping tools.

Experience Management

The tools in this category include IT service management, software asset management, IT asset management, IT financial management and business value dashboards (BVDs). The experience management minisuite focuses on improving the overall level of quality and efficiency with which the I&O organization delivers and supports increasingly digital customer experiences. To date, digitalization's impact on this space has been largely focused on providing a greater variety of support channels. However, the disruptive impacts of SaaS delivery models and advanced analytical technologies (such as artificial intelligence for operations [AIOps]) are expected to grow. More often than not, the IT service desk function in I&O organizations is the main consumer of tools that are a part of this minisuite. In more mature organizations, however, use of these tools will grow and expand beyond just the IT service desk.

I&O Business Value Dashboards

I&O BVDs are used to quantify the business value of I&O performance to support business and IT leaders' decisions. BVDs are composed of audience-specific sets of business value metrics (themselves combinations of prioritized business objectives, business performance measures and I&O performance measures) that are delivered through presentation and reporting mechanisms.

IT Financial Management

IT financial management (ITFM) tools provide the detailed cost and consumption analysis required to run IT like a business. These tools are typically IT-owned and managed financial applications that support strategic decision making, financial planning, budget justification, chargeback/showback, performance analytics, benchmarking and value measurement capabilities. They are designed to improve IT financial decision making by providing multiple views into the total cost of IT. The overarching requirement that binds the ITFM market is the desire to understand IT spend at a total cost view. This means the aggregation of all relevant IT costs, whether at the technology, application or service level, or from an investment perspective. ITFM tools do not replace enterprise financial systems, nor should they require modification to corporate systems of record like the general ledger. Rather, they provide I&O leaders with a purpose-built application designed to aggregate all IT spend and consumption data from disparate systems of record and allocate that data against a cost model designed to provide transparency into IT spending.

IT Service Management

ITSM tools help I&O organizations manage the consumption of IT services, the infrastructure that supports the IT services and the IT organization's responsibility in delivering these services. They are most heavily used by IT service desks and IT service delivery functions to support the tasks and workflows for processes including incident, request, problem, change, service level, knowledge and configuration management.

ITSM tools are classified based on ITSM capabilities and integration with ITOM solutions and include:

- Basic ITSM tools that have some ITSM capabilities and limited integration with ITOM solutions
- Intermediate ITSM tools that have good ITSM capabilities and provide some basic ITOM functions or integrate with intermediate third-party ITOM solutions
- Advanced ITSM tools that have a full range of ITSM capabilities and provide broad ITOM functionality natively or integrate with advanced third-party ITOM solutions

Vendors are increasingly concentrating product development on non-I&O use cases as market saturation of ITSM tools continues. The adaptation of the platform's workflow capabilities outside of ITSM functionality (such as for HR case management or facilities management) is not evaluated within this research.

ITSM tools are a component of the experience management ITOM tools minisuite. The experience management minisuite focuses on improving the overall level of quality and efficiency with which the I&O organization supports business users. For deeper ITOM capability, ITSM tools may optionally integrate with other tools from the delivery automation minisuite or the performance analysis minisuite.

For more information, see [Magic Quadrant for IT Service Management Tools](#).

Software Asset Management

Software asset management (SAM) is a framework and set of processes that allow organizations to strategically track and manage the financial, physical, licensing and contractual aspects of software assets during their life cycle. It plays an important role in the acquisition and life cycle management of software, including strategies to identify and eliminate underutilized software, the consolidation of licenses, or the move to new licensing models. The SAM discipline aims to create a dependable account of software asset costs and risks, providing support for software strategy, architecture, service management, funding and sourcing decisions.

SAM tools automate many of the tasks required to maintain compliance with software licenses, thereby controlling software spending. They facilitate the in-depth analysis of software assets by decoding software license entitlements, automating the collection of software consumption data, establishing independent software vendor (ISV) effective license position (ELP), and optimizing software value delivery and information sharing.

SAM tools manage entitlements from enterprise license agreements, purchases and other records to automatically determine and optimize license position against discovered software and make this information available to improve business process performance. I&O leaders use them for managing software entitlement, in lieu of using spreadsheets, due to the rising complexity of software-licensing schemes. Specifically, Gartner breaks down SAM into nine discrete activities:

1. Discover software procurements (for entitlement)
2. Identify software entitlements
3. Normalize software entitlements
4. Discover platforms
5. Identify platform consumption
6. Normalize software consumption data
7. Reconcile software asset information
8. Optimize software entitlements and consumption
9. Share software asset information

For more information, see [Magic Quadrant for Software Asset Management Tools](#).

IT Asset Management

IT asset management (ITAM) provides a dependable account of technology asset life cycle costs and risks to maximize the business value of technology strategy, architecture, funding, sourcing and procurement decisions.

The ITAM discipline includes:

- Building and enhancing a dynamic ITAM program
- Managing software assets including the process and governance aspects as well as software asset management (SAM) tools
- Managing software license audits to minimize risk and cost
- Managing and optimizing technology hardware assets via hardware asset management (HAM) tools
- Minimizing the dual IT asset disposition (ITAD) risks of data security and environmentally detrimental recycling

For the purposes of market sizing and forecast, however, Gartner separates SAM tools out from the rest of ITAM software.

Performance Analysis

These tools are software products, including enterprisewide consoles and management suites that are used to monitor and manage the availability and performance of applications and infrastructure. Measuring across multiple perspectives (experiential, transactional, technical), these tools analyze a variety of elements, such as:

- Physical and virtual infrastructure
- Software
- OSs
- Servers
- Systems
- Networks
- Storage
- Security
- Databases
- Applications
- Containers

- Mainframe elements

Performance analysis tools are sometimes deployed and managed in-house, delivered as a service, delivered as a managed service or outsourced from a third-party provider. The following subcategories of performance analysis tools differ in their scope and approach to data analysis.

Artificial Intelligence for Operations

AIOps platforms combine big data and ML functionality to support all primary IT operations functions through the scalable ingestion and analysis of the ever increasing volume, variety and velocity of data generated by IT. The platform enables the concurrent use of multiple data sources, data collection methods, and analytical and presentation technologies.

AIOps can enhance a broad range of IT operations processes and tasks, including performance analysis, anomaly detection, event correlation and analysis, IT service management and automation. Its central function is:

- Ingesting data from multiple sources agnostic to source or vendor
- Enabling data analytics at two points:
 - Real-time analysis at the point of ingestion
 - Historical analysis of stored data
- Providing access to the data
- Storing the acquired data
- Using machine learning
- Initiating an action or next step based on the result of analysis

The goal of the analytics effort is to:

- Discover patterns — novel elements used to look forward in time to predict possible incidents and emerging usage profiles
- Look backward in time — to determine the root causes of current system behaviors

For more information, see [Market Guide for AIOps Platforms](#).

Application Performance Monitoring Suites

Gartner defines the application performance monitoring market as software that facilitates application monitoring to meet three main functional dimensions:

1. **Front-end monitoring** — This is an availability and performance monitoring discipline that is an element of digital experience monitoring (see [Market Guide for Digital Experience Monitoring](#)). For the purposes of this research, it will include support for real-user monitoring (RUM) and synthetic transaction monitoring for both web- and mobile-based end users. The description of front-end monitoring is an evolution from last year's Magic Quadrant for Application Performance Monitoring. In the prior version, it was referred to as digital experience monitoring.
2. **Application discovery, tracing and diagnostics (ADTD)** — This is a set of processes designed to understand the relationships between application servers, map transactions across these nodes, and enable the deep inspection of methods using bytecode instrumentation (BCI) and/or distributed tracing.
3. **Analytics** — The APM solution must provide domain-centric AIOps functions (see [Market Guide for AIOps Platforms](#)), employing event correlation and anomaly detection, as well as root cause analysis on APM-acquired data within the context of topology. The solution may optionally also provide domain-agnostic capabilities for events acquired from third-party collectors. The description of analytics is an evolution from last year's [Magic Quadrant for Application Performance Monitoring](#). In the prior version, it was referred to as "AIOps."

Gartner continues to include digital experience monitoring (DEM), now called "front-end monitoring," and AIOps, now called "analytics" in the Magic Quadrant for Application Performance Monitoring, as components of our APM software evaluations, while also evaluating them as separate subsegments of the performance analysis market.

For more information, see [Hype Cycle for IT Performance Analysis, 2020](#).

Capacity Planning and Management Tools

Capacity planning and management tools enable IT leaders to plan, manage and optimize the use of IT infrastructure and application capacity for both business and IT services. They go beyond trending, providing “what if” scenario modeling based on business and IT data. Some tools also provide a real-time view of workload performance and offer continuous optimization guidance for physical, virtual and cloud environments.

Digital Experience Monitoring

DEM is a performance analysis discipline that supports the optimization of the operational experience and behavior of a digital agent, human or machine, with the application and service portfolio of enterprises. This discipline also seeks to observe, model and manage the behavior of digital agent communities as they collectively engage with enterprise application and service portfolios.

Dynamic Optimization Technology

Dynamic optimization technology uses telemetry, algorithms, service and resource analytics, and policies to drive real-time automated actions that reduce waste, cost and risk exposure while improving service levels. It helps reduce cloud service and virtual infrastructure sprawl and cost while improving governance and compliance. The technology capability can be incorporated as part of the CMP or implemented as separate software, either as an independent product or a component of a broader set of functionality.

IT Event Correlation and Analysis Tools

IT event correlation and analysis (ECA) tools are general-purpose platforms that monitor multiple IT domains from applications and servers (physical and virtual), to networks and storage. ECA is critical for analyzing root causes of availability and performance problems. ECA tools:

- Consolidate, filter and correlate events
- Notify the appropriate IT operations staff of critical events
- Automate corrective actions when possible (directly or through integrations with ITPA, trouble ticketing, CRM or other systems)
- Serve as a “manager of managers” for IT operations teams

IT Infrastructure Monitoring

IT infrastructure monitoring (ITIM) tools capture the availability of the IT infrastructure components that reside in a data center or are hosted in the cloud as IaaS. These tools monitor and collate the availability and resource utilization metrics of servers, networks, database instances, hypervisors and storage. Notably, these tools collect metrics in real time and perform historical data analysis or trending of the elements they monitor.

For more information, see [Market Guide for IT Infrastructure Monitoring Tools](#).

Network Fault Management

Network fault management (NFM) tools collect, contextualize and prioritize network alerts to ascertain the status of network elements like routers and switches. Alerts are isolated, aggregated, reduplicated, filtered and prioritized. Some NFM tools discover and visualize the physical and logical topology and dependencies among devices. This aids in depicting those elements via contextual maps, provides basic RCA, and enhances alert deduplication and suppression.

Network Performance Monitoring and Diagnostics

NPMD tools leverage a combination of packet data, flow data and infrastructure metrics to provide a historical, real-time and predictive view into the availability and performance of the network and the applications running on it. NPMD tools also provide the diagnostic workflows and forensic data to identify the root cause of network and application degradations, increasingly through AIOps functionality. Finally, NPMD tools provide insight into the quality of the end-user experience, based on network-derived performance data.

Wireless Network Monitoring Tools

Wireless network monitoring (WNM) tools provide proactive notification of potential and actual performance problems in wireless LAN environments. Extended features include reporting compliance with regulatory standards, as well as rogue access point detection. The tools provide reactive troubleshooting and remediation by measuring usage metrics of an organization's wireless infrastructure, such as:

- Connection rates and quality
- Client throughput and data rates
- Packet latency
- Voice quality

- Utilization
- Signal strength
- RF interference

Virtual Desktop Infrastructure Monitoring

Virtual desktop infrastructure monitoring (VDIM) tools provide end-user-focused, end-to-end monitoring of centralized desktop delivery platforms. Virtual desktop infrastructure (VDI) platforms enable applications to execute on the server side, but render on the client side.

Currently, VDIM tools tend to specialize in one or two of the following areas:

- Visibility of underlying infrastructure components
- Visibility of the VDI platform
- Perception from the end user's perspective

Other Monitoring Tools

Other monitoring tools that are no longer actively covered but whose revenue remains in this category include capacity planning and management tools, network packet brokers, and network fault monitoring tools.

ITOM Mainframe Tools

Included here are tools for managing and monitoring mainframe implementations. A roll-up of mainframe categories captured here include application performance monitoring, monitoring, DBMS management, automation, workload automation and ITPA.

Other ITOM

Other ITOM includes any management tools and/or integrated functionality not specifically covered within the named categories detailed previously. Tools in this category include, but are not limited to, output management software used to manage hardware peripherals, such as printers. Emulators are windows/portals into mainframe, mini- and other platforms.

DBMS management (previously a separate category) has been rolled into this category. Included here are database administration automation and support tools that automate routine administration of databases, schema development and management, query analyzers, reorganization utilities, space tuners, and bulk data loading/unloading technologies.

Operating Systems

Market Analyst: Vanitha D’Silva

See Table 14 for an overview.

Table 14: Operating Systems Market Overview

Operating Systems			
UNIX	Linux	Windows	Others
<div><div></div> IBM AIX</div> <div><div></div> HP-UX</div> <div><div></div> macOS</div> <div><div></div> Other UNIX</div>	<div><div></div> Red Hat</div> <div><div></div> SUSE</div> <div><div></div> Canonical (Ubuntu)</div> <div><div></div> Oracle Linux</div>	<div><div></div> Windows Client</div> <div><div></div> Windows Server</div>	<div><div></div> System z/OS</div> <div><div></div> Other OSs</div>

Source: Gartner (June 2021)

Notes for Table 14: OS = operating system

An OS is software that, after being loaded into the computer by an initial boot program, manages a computer’s resources, controlling the flow of information into and from a main processor. OSs perform complex tasks, such as memory management, control of displays and other I/O peripheral devices, networking and file management, and other resource allocation functions between software and system components. The OS provides the foundation on which applications, middleware and other infrastructure components function. An OS usually provides user interfaces, such as command line shell and GUI, for interaction between user and computer.

OS revenue is tracked for analyzing the changing popularity of different platforms provided by software vendors. We track the following key subsegments in OS:

- UNIX
- Linux
- Windows
- Others

Client OSs run on stand-alone devices, such as desktops and laptops, and are designed to be used by a single individual on a single device. Examples include Windows (client) and macOS. Server OSs run on more-powerful hardware, often with multiple CPUs or multicore CPUs, and are designed to be accessed by many users in a shared fashion simultaneously. They are Windows (server), Linux (server), System z/OS, UNIX and other server OSs.

With the advent of virtualization technologies, many OSs are deployed and reside in the form of a virtual machine (VM). Many users consider VMware's vSphere, open-source Xen/KVM and Microsoft's Hyper-V to be OSs because they perform hardware control functions that an OS normally does. Gartner classifies virtualization software as a segment different from the OS software segment.

UNIX

UNIX is a multitasking, multiuser OS, which is portable to multiple server platforms. It was developed as an alternative to proprietary minicomputer OSs. Today, UNIX can be found on platforms based on Intel's Itanium product family and Xeon, AMD's Opteron, IBM's POWER, Hewlett Packard's PA-RISC, Oracle and Fujitsu's UltraSPARC and SPARC64, and other reduced instruction set computer (RISC) platforms.

We segment software running on UNIX OSs into these categories:

- IBM AIX
- HP-UX
- macOS
- Other UNIX, including Oracle Solaris, Tru64 UNIX, IRIX and other unspecified UNIX

Linux

Linux is a UNIX-like computer OS and was originally designed as free software for open-source development. Its source code can be freely modified, used and redistributed by anyone under the GNU Public License. Of the many distributions of Linux, the most-popular enterprise versions include those from Red Hat (Red Hat Enterprise Linux), SUSE (SUSE Linux Enterprise Server), Canonical (Ubuntu) and Oracle Linux.

Windows

Windows Client

Microsoft's Windows client operating environment is targeted and priced for consumer and business end users on personal devices. This category includes all Windows predecessors and currently Windows 10.

Windows Server

This category encompasses Microsoft's 32-bit and 64-bit server operating environments for more-powerful hardware platforms, including multiprocessor and multicore platforms, and that include networking and sharing features not found in Windows client OSs. Products here include all Windows Server predecessors and currently Windows Server 2019.

Others

System z (z/OS, z/VM, z/VSE, z/TPF)

These are IBM's OSs for System z mainframe and computers. Older versions and product names include MVS, VM and OS/390.

Other OSs

This category includes any operating environment software platform not included in the above categories, such as Solaris, Tru64, NonStop, System i, NetWare, OS/2, DOS, VMS, embedded OSs and other OSs. Proprietary mainframe OSs developed by Japanese vendors are also included here.

Security Software

Market Analyst: Rustam Malik

See Tables 15 and 16 for an overview.

Table 15: Security Software Market Overview (1)

Security Software (1)				
Integrated Risk Management	Application Security	Consumer Security Software	Infrastructure Protection	Identity Access Management
	<ul style="list-style-type: none"> ■ Application Security Testing ■ Vulnerability Assessment ■ Web Application Firewall 		<ul style="list-style-type: none"> ■ Endpoint Protection Platforms (Enterprise) ■ Secure Email Gateways ■ SIEM Software ■ Secure Web Gateways ■ Threat Intelligence 	<ul style="list-style-type: none"> ■ Identity Governance and Administration ■ Access Management ■ Privileged Access Management ■ User Authentication

Source: Gartner (June 2021)

Notes for Table 15: SIEM = security information and event management

Table 16: Security Software Market Overview (2)

Security Software (2)		
Data Security	Cloud Access Security Brokers	Other Security Software
<ul style="list-style-type: none">■ Enterprise Data Loss Prevention■ Encryption■ Tokenization		

Source: Gartner (June 2021)

Integrated Risk Management

Integrated risk management (IRM) solutions provide a vertically integrated view of risk — from an organization’s strategy to its business operations and ultimately into the enabling technology assets — through a range of solutions. Solutions range from purpose-built applications to single-vendor, integrated solution sets across six primary use cases. The use cases include:

1. **Digital risk management (DRM)** — DRM technology integrates the management of risks of digital business components (such as cloud, mobile, social and big data) and third-party technologies (such as AI and ML, OT, and IoT).
2. **Vendor risk management (VRM)** — VRM programs help organizations manage the risks of third parties with adequate controls for business continuity management, performance, viability, security and data protection. Failure to comply with these mandates can have significant customer-, service-, audit- and, for some industries, regulatory-related repercussions that can undermine shareholder value and corporate viability. The VRM use case addresses risks to regulatory compliance, information security and vendor performance arising from enterprises’ increased use of (and reliance on) service providers and IT vendors. Solutions geared toward this use case have capabilities such as risk assessment, risk monitoring and/or risk rating.

3. **Business continuity management (BCM)** — BCM is the practice of coordinating, facilitating and executing activities to identify risks of business disruptions, implement disaster recovery solutions and recovery plans, respond to disruptive events, and recover mission-critical business operations. BCM software automates processes such as risk assessment; business impact analysis (BIA); and recovery plan development, implementation and invocation. Critical and enhanced capabilities that address BCM help organizations to initiate BCM programs and improve overall continuity capabilities.
4. **Audit management (AM)** — Auditors independently and objectively evaluate, analyze and assess the effectiveness of an organization's system of internal control, governance processes and risk management capability. Auditors provide assurance, insight and recommendations on operational improvements to the board of directors, senior management and business process owners. Auditors do this through both auditing and consulting activities. The AM solution market automates internal audit operations, such as audit planning, scheduling, work paper management, time and expense management, reporting, and issue management.
5. **Corporate compliance and oversight (CCO)** — As the compliance management program scope increases, regulatory compliance and change management become more complicated. An increased focus on commercial compliance (increasingly required by business partners) and organizational compliance requirements (such as ethics and corporate social responsibility) makes compliance managers' roles challenging. CCO software supports the goals and activities of compliance leaders. CCO provides automated policy development and management, compliance risk assessment, control rationalization, assessment and attestation, regulatory change management, and investigative case management.
6. **Enterprise legal management (ELM)** — ELM software applications are focused on supporting legal and compliance departments, corporate secretaries, boards of directors, and senior management. ELM provides better documentation, spend management, information availability and collaboration via an integrated set of applications. These applications include matter management, e-billing, financial/spend management, legal document management and business process management.

Application Security

Application Security Testing

Gartner defines the application security testing (AST) market as the buyers and sellers of products and services designed to analyze and test applications for security vulnerabilities. Gartner identifies four main styles of AST:

1. **Static AST (SAST)** technology analyzes an application's source, bytecode or binary code for security vulnerabilities, typically at the programming and/or testing software life cycle (SLC) phases.
2. **Dynamic AST (DAST)** technology analyzes applications in their dynamic, running state during testing or operational phases. It simulates attacks against an application (typically web-enabled applications and services), analyzes the application's reactions and, thus, determines whether it is vulnerable.
3. **Interactive AST (IAST)** technology combines elements of SAST and DAST simultaneously. It is typically implemented as an agent in the test runtime environment (for example, instrumenting the Java Virtual Machine [JVM] or .NET Common Language Runtime [CLR]) that observes operation or attacks and identifies vulnerabilities.
4. **Mobile AST** performs SAST, DAST, IAST and/or behavioral analysis on byte or binary code to identify vulnerabilities in mobile applications.

Vulnerability Assessment

The vulnerability assessment market is composed of vendors that provide capabilities to identify, categorize and manage vulnerabilities, such as unsecure system configurations or missing security updates in network-attached devices.

Web Application Firewall

A web application firewall (WAF) is a shielding safeguard positioned in front of web servers, intended to protect web applications. WAFs focus primarily on web server protection at Layer 7 – the application layer – which includes classes of “self-inflicted” vulnerabilities in configured commercial applications or in custom-developed code and may also include safeguards against some attacks at other layers.

Consumer Security Software

This category includes stand-alone suites of endpoint security products, including antivirus, anti-spyware, personal firewalls and host-based intrusion prevention systems (HIPSs). Desktop and subscription antivirus sold or rented to the small office/home office (SOHO) segment and consumers only are included in this subsegment.

Infrastructure Protection

Endpoint Protection Platforms (Enterprise)

This category comprises centrally managed suites of endpoint security products, including endpoint-delivered anti-malware, personal firewalls, data loss prevention (DLP), whole-disk encryption, web filtering and host intrusion prevention. Endpoint protection platform (EPP) suites also include emerging capabilities for advancing threats, such as exploit prevention, device control, malicious script detection and application control.

As the market has evolved, our EPP segment also includes endpoint detection and response (EDR) capabilities. These include detecting malicious activities more broadly including live analysis, containment, threat investigation, threat hunting and incident response capabilities to recover from an endpoint security threat.

Secure Email Gateways

Secure email gateway (SEG) solutions (software, appliances or managed services) scan or block inbound email at the SMTP gateway for viruses, spam and malicious code. Increasingly, these gateway solutions may also scan outbound email for compliance with internal policies.

Security Information and Event Management Software

This category includes security information and event management (SIEM) software products providing:

- **Security event management** — The ability to process near-real-time data from security devices and systems to determine when security events of interest have occurred
- **Security information management** — Reporting and historical analysis to support security policy compliance management and the generation of security metrics

Appliance — Security Information and Event Management Software

This category includes SIEM appliance products providing:

- **Security event management** — The ability to process near-real-time data from security devices and systems to determine when security events of interest have occurred
- **Security information management** — Reporting and historical analysis to support security policy compliance management and the generation of security metrics

Secure Web Gateways

Secure web gateway (SWG) solutions protect web-surfing PCs from infection and enforce company policies. A secure web gateway is a solution that filters unwanted software/malware from user-initiated web/internet traffic and enforces corporate and regulatory policy compliance. These gateways must, at a minimum, include URL filtering, malicious-code detection and filtering, and application controls for popular web-based applications (such as IM and Skype). Native or integrated data leak prevention is also increasingly included. This also includes SWG appliance products.

Threat Intelligence

Threat intelligence is evidence-based knowledge, including context, mechanisms, indicators, implications and action-oriented advice about an existing or emerging menace or hazard to assets. This intelligence can be used to inform decisions regarding the subject's response to that menace or hazard. Threat intelligence is made available through portals, online delivered feeds, subscription-based analyst personnel support and platform software.

Identity Access Management

Identity Governance and Administration

Identity governance and administration (IGA) solutions manage identity and access life cycles across multiple systems. Core functionality includes automated provisioning of accounts among heterogeneous systems, fulfillment of access requests (including self-service), password management, governance over user access to target systems via workflows and automated policies, and access certification processes. Additional capabilities often included in IGA systems are risk scoring of a user's combined entitlements, segregation-of-duties enforcement, role management, role mining, audit case incident management and analytics (historical change, performance, recommendations for entitlements or certifications, and so forth).

Access Management

Access management refers to technologies that use access control engines to provide centralized authentication, single sign-on (SSO), session management and authorization enforcement for target applications in multiple use cases (such as B2E, B2B and B2C). Target applications may have traditional web application architectures, native mobile architectures or hybrid architectures. Increasingly, target systems include APIs. Smart or constrained devices with or without human operators may be incorporated as well. Applications may run on the customers' premises or in the cloud.

Privileged Access Management

Privileged access management (PAM) technologies help organizations provide secure, privileged access to critical assets, and meet compliance requirements by securing, managing and monitoring privileged accounts and access.

User Authentication

Gartner defines user authentication as “the real-time corroboration of a person’s claimed digital identity with an implied or notional level of trust.” User authentication technologies are contiguous with other “trust technologies,” such as identity proofing and online fraud detection (OFD); the boundaries between them are increasingly fuzzy. In the long term, Gartner projects that converge analytics-led solution sets will be the norm. User authentication capabilities are delivered via discrete software, hardware or cloud-based services, or are embedded in other offerings such as OSs and access management tools.

Data Security

Enterprise Data Loss Prevention

Enterprise DLP products incorporate sophisticated detection techniques to help organizations address their most critical data protection requirements. Products are packaged in agent software for desktops and servers, physical and virtual appliances for monitoring networks and agents, or soft appliances for data discovery. Leading characteristics of enterprise DLP products include a centralized management console, support for advanced policy definition, event management workflow and reporting. Enterprise DLP functions as a comprehensive system to discover sensitive data within an organization and mitigate the risk of its loss at the endpoints, in storage and over the network. This segment does not include DLP integrated as part of another product such as SEGs, SWGs or cloud access security brokers (CASBs).

Encryption

Encryption is a method used to secure data while it is at rest and when being transmitted. Encryption uses algorithms to transform plain text into ciphertext and requires keys to decrypt the information back to its original plain text. Encryption can be used together with tokenization or individually. For example, a database with tokenization applied can be further protected using encryption. The encryption products we will track in this market include file, folder and database encryption, and the key management systems that support them. It excludes hardware security modules (HSMs), CASB encryption licenses, encryption found on endpoints and native encryption with SaaS applications.

Tokenization

Tokenization is a method used to secure data while it is at rest and when being transmitted. Tokenization turns plain text into a random string of characters derived from a database called a “token vault” versus a key vault or key management system used in encryption. Tokenization can be used together with encryption or individually.

Cloud Access Security Brokers

CASBs are on-premises or cloud-based security policy enforcement points that mediate (broker) between cloud service consumers and cloud service providers to interject enterprise security controls and enforce policies. CASB platforms consolidate multiple types of security policy enforcement, such as cloud service discovery, cloud provider risk ratings, single sign-on, authorization, device profiling, encryption, tokenization, sensitive data monitoring, user behavior monitoring and logging.

Other Security Software

This category contains miscellaneous security software only, and it is meant to include all software not mentioned in the detailed listing. Services and any equipment for these purposes are not included.

Storage Software

Market Analyst: Chandra Mukhyala

See Table 17 for an overview.

Table 17: Storage Software Market Overview

Storage Management Software				
Archive	Backup and Recovery	Software-Defined Storage	Storage Resource Management	Other Storage Software

Source: Gartner (June 2021)

This market includes all software products sold as value-added options to run on a server, storage network device or storage device, or as a web service to aid in managing the device or managing, retaining and protecting the data. Revenue is for new license sales, service subscriptions, and maintenance and support services that include new version license sales to update an existing license to a new version, telephone support and on-site remedial support. Revenue does not include professional services. For products to be included in this coverage, they must represent a revenue stream for the company that is separately tracked and not simply part of a bundled product or service. Hosted storage management solutions, such as hosted backup or hosted archiving, are included in this market.

Storage software coverage is primarily targeted at enterprise data management, including mainframe storage, but not for data on endpoint devices like desktops and tablets. The storage software market is divided into five segments. Storage software is the sum of all the segments. It represents all the tools needed to manage the capacity, performance, availability, retention and compliance of data stored in all types of on-premises and cloud storage, as well as the networking devices that the data may pass through.

Archive

Archiving products operate on defined retention policies often providing for the storage of a point-in-time version of data for historical reference. Archive data can be migrated to a secondary storage repository or have retention tags applied to hold in place. Active archiving products provide special technology for searching and viewing archived data, and they are generally deployed for purposes of storage efficiency and performance; compliance, governance and data management; e-discovery support; and application performance optimization and retirement.

Backup and Recovery

Backup and recovery software products are designed to:

- Capture a copy (backup) of data
- Write it out to a secondary device, such as tape, disk or an optical device, and/or to a public or private cloud
- Provide recovery of that data when needed

This segment also includes software products focused specifically on supporting the recovery process, such as the software components of virtual tape libraries and other disk-based backup solutions. Additional software offerings included are media management, deduplication and backup reporting products, as well as archiving that is built into the backup application without additional charge.

Software-Defined Storage

Software-defined storage (SDS) creates and provides data center services to replace or augment traditional storage arrays. It can be deployed as a virtual machine (VM), as a container, or as software on a bare-metal x86 industry standard server, allowing organizations to deploy a storage-as-software package. These products create a storage solution that can be accessible by file, block or object protocols. It can be deployed as an out-of-band technology with robust policy management, input/output (I/O) optimization and automation functions to configure, manage and provision other storage resources. SDS products enable abstraction, mobility, virtualization, storage resource management (SRM) and I/O optimization of storage resources to reduce expenses, making external storage virtualization software products a subset of the SDS category.

Storage subsystems and storage area network (SAN) infrastructure component software products provide configuration utilities and agents that collect capacity, performance and status information — usually for a single device type or a set of devices from a single vendor.

Storage Resource Management

SRM products provide data collection and automation agents that consolidate and operate on information from multiple platforms supporting storage management tools on multiple OSs, storage devices and SAN devices. Key functions include:

- Reconciliation of application, server and storage usage
- Capacity reporting, forecasting and analysis
- Performance reporting and analysis
- Capacity and performance management automation
- Resource availability
- Storage provisioning
- Storage management product integration

- Application and database integration
- Hardware integration

Basic network and system management (NSM) integration should provide the ability of the SRM product to externalize events to other management products. Product-specific integration includes the ability to launch the SRM product from the NSM console. Integration with device resource management products and media management products should include launch of hardware configuration utilities from the SRM console, collection and reporting of agent information, and integration of logical-level data. Typical SRM tools require a SAN management tool to manage and collect data from heterogeneous devices on the SAN. Stand-alone SAN management tools are also included in the SRM segment. Products that provide for discovery, topology mapping and monitoring of SAN components are also included in this segment because many are being included with SRM suites or are expanding to include SRM functionality. SRM tools may offer real-time or historical views into one or several of the physical, volume/virtual, file or database levels and/or point-in-time copy views.

Other Storage Management Software

The other Storage software subsegment includes storage software products for managing mainframe implementations, file analysis and other storage software products that are not tracked in the named segments.

Virtualization Infrastructure Software

Market Analyst: Brandon Medford

See Table 18 for an overview.

Table 18: Virtualization Infrastructure Software Market Overview

Virtualization Infrastructure Software		
x86 Server Virtualization Infrastructure	Virtual Desktop Infrastructure	Server-Based Computing

Source: Gartner (June 2021)

x86 Server Virtualization Infrastructure

x86 server virtualization infrastructure includes the hypervisor, VM and virtual machine monitors (VMMs) for the x86 processor family. The key to “virtualizing” a server is the hypervisor, whereas the virtualization management software provides the ability to administer and operate at scale. A hypervisor is a layer of software that runs directly on hardware and allows the definition of fixed partitions with predefined priorities for accessing hardware resources. (The term “software” can mean including preloaded software that may run in a protected area or microcode/firmware, depending on the implementation.) These partitions are incomplete VMs because they prioritize, but do not share, all hardware resources. To support flexible configuration, a hypervisor in general is implemented with a VMM. The VMM virtualizes all hardware needed for VMs to run. Most x86 server virtualization products currently labeled as hypervisors bundle a VMM and create added value, as well as differentiation, within the virtualization management layer.

OS virtualization was added to this document in 2014, but it is not formally forecast at this time, nor are VM-integrated containers. Containers are an OS virtualization technology that enables multiple applications to share an OS kernel. It is different from virtualization using a hypervisor, sometimes known as partitioning virtualization.

(Note: Virtualization management software is reported under the ITOM software market segment.)

Virtual Desktop Infrastructure

VDI is a full, thick-client user environment run as a VM on a server and accessed remotely. VDI implementations comprise:

- Server virtualization software to host desktop software (as a server workload)
- Brokering/session management software to connect users to their desktop environments
- Tools for managing the provisioning and maintenance (for example, reimages) of the virtual desktop software stack

It does not include associated hardware, such as thin clients.

Note: This forecast category was renamed from “hosted virtual desktop” in 2017 to align with other Gartner research teams. No other change was made to the category or its forecast assumptions (and so forth) as a result of the renaming. Desktop as a service (DaaS) and cloud-based virtual desktops are not included.

Server-Based Computing

Server-based computing is remote, shared-server OS execution of Windows applications and/or desktops that can be delivered to numerous device types, including tablets, using dedicated software agents or via web browser technologies. It is also known as remote desktop services, terminal services and presentation virtualization.

Starting in 2019, revenue for server-based computing has been included as a category in Gartner Market Share and Forecast reports.

Other Infrastructure Software

Other infrastructure software includes, but is not limited to, clustering and remote-control software, IT resilience orchestration automation software, directory servers, OS tools, Java license fees, mainframe infrastructure, and mobile and wireless infrastructure. It also includes other infrastructure software that is reported in vendors' income statements but is not reported in our Market Share publications.

Cloud Communications Platform Services

Communications PaaS (CPaaS) offers application leaders a cloud-based middleware platform on which they can develop, run and distribute communications software. The platform offers APIs and software development kits (SDKs) that enable custom development and simplify the integration of communications capabilities (for example, voice, messaging and video) into apps, services or business processes. This accelerates time to market and reduces the development costs of applications.

Developers can write applications on the platform using web languages and libraries (such as Ruby, Node.js, Python and C#), as well as drag-and-drop visual builders that remove the need for coding. CPaaS providers offer tools and documentation — either complete SDKs, or individual libraries, APIs and IDEs — to simplify the development process.

In addition to communication APIs, CPaaS vendors may also offer modules/wrappers and visual builders. These act as software development shortcuts and help accelerate the cycle time to develop apps. They may originate from the platform owner or from third parties, and can be purchased from an online marketplace.

IT Resilience Orchestration Automation

IT resilience orchestration automation solutions provide improved IT service availability, recovery and integrity through the automation of application workload failover and failback. They also provide improved data integrity and consistency between a primary production data center and a secondary recovery site, which may be an internal data center, a provider-managed data center or a virtual data center in a public cloud.

Worldwide Geographic Regional Definitions

Market share data is collected by the following regions and countries identified as “countries of specific interest.” Note that software vendor revenue research does not yet cover all these countries. “Rest of ...” indicates the balance of data for that region.

Eastern Europe Region

Countries of Specific Interest

Czech Republic, Hungary and Poland.

Rest of Eastern Europe

Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Latvia, Lithuania, North Macedonia, Moldova, Montenegro, Serbia, Slovakia and Slovenia.

Emerging Asia/Pacific Region

Countries of Specific Interest

India, Indonesia, Malaysia and Thailand.

Rest of Emerging Asia/Pacific

American Samoa, Ashmore and Cartier Islands, Baker Island, Bangladesh, Bhutan, Bouvet Island, Brunei Darussalam, Cambodia, Christmas Island, Cocos (Keeling) Islands, Cook Islands, Coral Sea Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Kiribati, Laos, Macau, Maldives, Marshall Islands, Micronesia, Midway Islands, Myanmar (Burma), Nauru, Nepal, New Caledonia, Niue, Norfolk Island, North Korea, Northern Mariana Islands, Pakistan, Palau, Palmyra Atoll, Papua New Guinea, Philippines, Solomon Islands, Spratly Islands, Sri Lanka, Timor-Leste (East Timor), Tokelau, Tonga, Tuvalu, Vanuatu, Vietnam, Wake Island, Wallis and Futuna and Western Samoa.

Eurasia

Countries of Specific Interest

Russia.

Rest of Eurasia

Afghanistan, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

Greater China Region

China, Hong Kong and Taiwan.

Japan Region

Japan.

Latin America Region

Countries of Specific Interest

Argentina, Brazil, Chile, Colombia and Mexico.

Rest of Latin America

Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Cayman Islands, Clipperton Island, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Montserrat, Navassa Island, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Tortola (British Virgin Islands), Trinidad and Tobago, Turks and Caicos Islands, Uruguay, Venezuela, and Virgin Islands (Saint John, Saint Croix and Saint Thomas, U.S.).

Mature Asia/Pacific Region

Countries of Specific Interest

Australia, New Zealand, Singapore and South Korea.

Middle East and North Africa Region

Countries of Specific Interest

Israel, Saudi Arabia and Turkey.

Rest of Middle East and North Africa

Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestinian Authority, Qatar, South Sudan, Sudan, Syria, Tunisia, United Arab Emirates and Yemen.

North America Region

Countries of Specific Interest

Canada and the U.S.

Sub-Saharan Africa Region

Countries of Specific Interest

South Africa.

Rest of Sub-Saharan Africa

Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo-Brazzaville, Côte d'Ivoire, Democratic Republic of Congo (formerly Zaire), Djibouti, Equatorial Guinea, Eritrea, Eswatini (formerly Swaziland), Ethiopia, Gabon, Gambia, Ghana, Guinea Republic, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Réunion, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, South Sudan, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

Western Europe Region

Countries of Specific Interest

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Rest of Western Europe

Andorra, Cyprus, Faroe Islands, Gibraltar, Greenland, Guernsey, Iceland, Isle of Man, Jersey, Liechtenstein, Luxembourg, Malta, Monaco, San Marino and Svalbard.

Channel Definitions

This section describes the channel definitions used by Gartner, where analyzed. Our software distribution channel research is intended to cover at least the two top segments.

Direct Channel

This is a channel through which hardware, software and peripherals are sold by the manufacturer directly to the end user:

- **Direct sales force** — This is a channel through which products move directly from the manufacturer or vendor to the end user, usually by a professionally trained field sales force.

- **Internal sales/sales development representative (SDR)** — This is a channel through which manufacturers sell their own products directly to end users through the use of the telephone, web, fax, fax-back and mail, including email and catalog.
- **Direct retail** — This channel includes storefront operations owned and managed by the vendor, typically a manufacturer of computer systems. This channel includes transactions through online properties. Direct stores are more common in Europe and Japan than in other parts of the world. Sales through direct stores are not reported separately by Gartner's worldwide services. They are grouped under direct sales force or one of the indirect channels.

Indirect Channel

This is a channel through which independent third-party organizations resell products. In software markets, VARs and system integrators are two typical examples of the indirect channel:

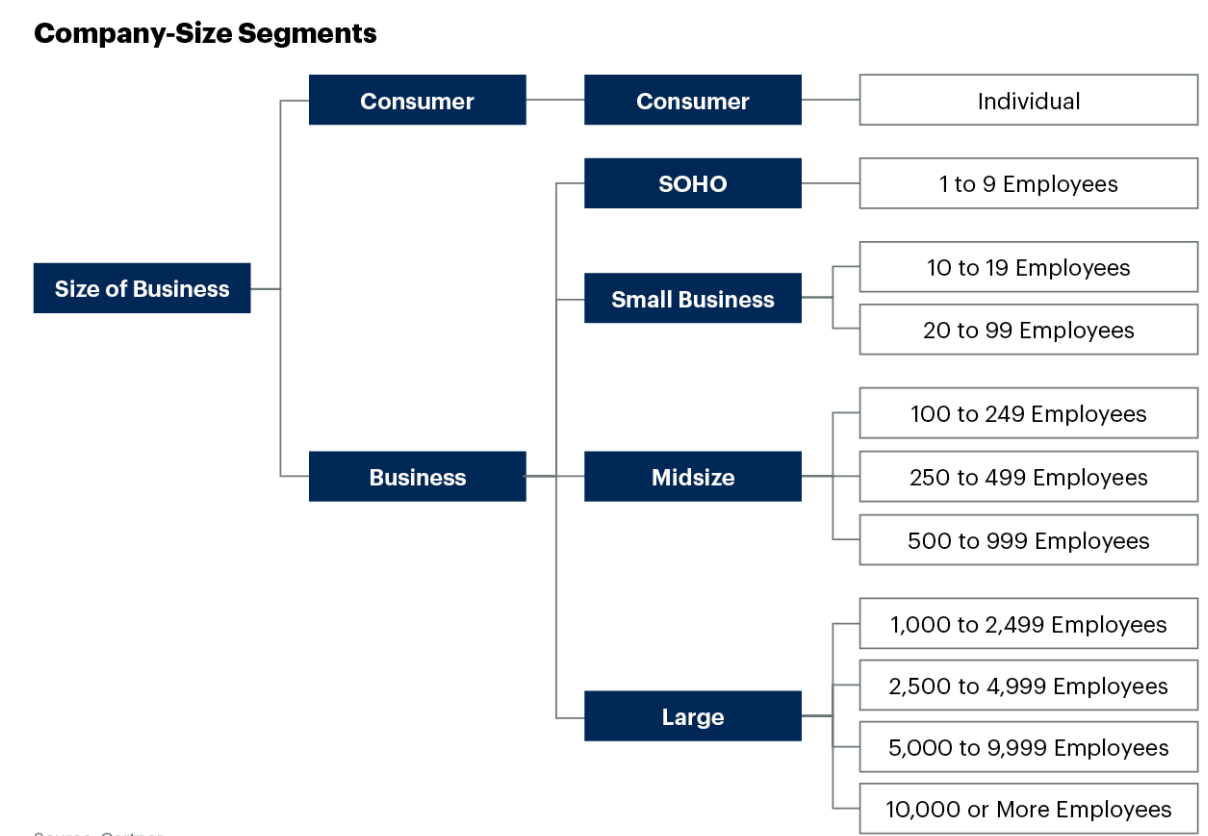
- **Dealer/Distributor**— Dealers are a group of resellers, including independent, regional and national organizations, that normally sell products and services to the business, education and government sectors. Client meetings are typically scheduled ahead of time and are most often solicited by an outbound sales force. Dealers usually provide a low level of service, training and customer assistance, as well as other value-added services.
- **Vendor-specific agent** — This is a reseller dedicated to selling one vendor's products. The reseller store will carry the logo and products of that vendor but is not owned by the vendor (for example, some Xerox copier resellers in the U.S.).
- **Indirect fax/phone/web** — This is a channel through which resellers sell a variety of products to end users through the use of the telephone, web, fax, fax-back and mail, including catalog sales. This is different from the direct fax/phone/web channel in that the products are sold by resellers rather than direct from the vendor.
- **VAR or solution provider** — This is a reseller that usually is not a storefront operation and typically acts as a consultant to clients. To qualify as a VAR, a reseller must have developed or configured some type of software package targeted at a particular market or offer significant integration expertise to the customer.
 - VARs typically generate 40% or more of their revenue from custom products, service and support. VARs do not apply their label to the product and may not own the hardware or software.

- **System integrators** — These are system vendors and independent service providers that supply professional services to apply, migrate and integrate technology into business processes.
- **Service provider** — Provides total support and services for customers’ projects but is less inclined to resell the technology and service provider’s (TSP’s) products.
- **Cloud service provider** — A provider of services hosted remotely from the customer and delivered via the internet.

Company-Size Segments

In our demand-side research, where analyzed, we seek to segment by organization/company size using the criteria shown in Figure 2.

Figure 2. Company-Size Segments



Source: Gartner

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Acronym Key and Glossary Terms

3D	three-dimensional
ABI	analytics and business intelligence
ABM	account-based marketing
ACID	atomicity, consistency, isolation and durability
AD	application development
ad tech	advertising technologies
ADLM	application development life cycle management
adPaaS	application development platform as a service
ADTD	application discovery, tracing and diagnostics
AEC	architecture, engineering and construction
AI	artificial intelligence
AIM	application infrastructure and middleware
AIOps	artificial intelligence for operations
AM	audit management
AMQP	Advanced Messaging Queuing Protocol
ANSI	American National Standards Institute
aPaaS	application platform as a service
API	application programming interface
APM	application portfolio management
AR	augmented reality
ARO	application release orchestration
AS	Applicability Statement
ASN.1	Abstract Syntax Notation One
AST	application security testing
ATDD	acceptance-test-driven development

autoML	automated machine learning
AWS	Amazon Web Services
B2B	business-to-business
B2C	business-to-consumer
B2E	business-to-employee
BAM	business activity monitoring
BCI	bytecode instrumentation
BCM	business continuity management
BDD	behavior-driven development
BFF	backends for frontends
BGS	business-to-business gateway software
BI	business intelligence
BIA	business impact analysis
BPA	business process analysis
BPM	business process management
bpmPaaS	business process management platform as a service
BPMS	business process management suite
BRE	business rule engine
BVD	business value dashboard
CADP	Citizen Automation and Development Platform
CAGR	compound annual growth rate
CAIDS	cloud artificial intelligence developer services
CASB	cloud access security broker
CASS	coding accuracy support system
CATI	computer-assisted telephone interviewing
CAX	computer-aided application

CCA	continuous configuration automation
CCaaS	contact center as a service
CCI	contact center infrastructure
CCO	corporate compliance and oversight
CCT	content collaboration tool
CD	continuous delivery
CDP	customer data platform
CDR	call detail record
CEAP	cloud-enabled application platform
CEC	customer engagement center
CI	continuous integration
CLI	command line interface
CLR	Common Language Runtime
CMP	cloud management platform
COBOL	Common Business Oriented Language
CODASYL	Conference/Committee on Data Systems Languages
COM	Component Object Model
COM+	Component Object Model+
CORBA	Common Object Request Broker Architecture
COTS	commercial off-the-shelf
CPaaS	communications platform as a service
CPM	corporate performance management
CPQ	configure, price and quote
CRM	customer relationship management
CSI	cloud service integration
CSP	content services platform

CSS	customer service and support
CUI	conversational user interface
CX	customer experience
DaaS	desktop as a service
DAST	dynamic application security testing
DBMS	database management system
dbPaaS	database platform as a service
DCC	digital content creation
DCO	dynamic creative optimization
DEM	digital experience monitoring
DLP	data loss prevention
DMP	data management platform
DMSA	data management solution for analytics
DoD	Department of Defense (U.S.)
DOM	distributed order management
DOS	disk operating system
DRAM	dynamic random-access memory
DRM	digital risk management
DRP	distribution requirements planning
DSP	demand-side platform
DXP	digital experience platform
EAD	enterprise-class agile development
EAM	enterprise asset management
EAP	enterprise agile planning
EBS	E-Business Suite (Oracle)
ECA	event correlation and analysis

ECM	enterprise content management
EDI	electronic data interchange
EDIFACT	United Nations Electronic Data Interchange for Administration, Commerce and Transport
EDR	endpoint detection and response
EFSS	enterprise file synchronization and sharing
ELM	enterprise legal management
ELP	effective license position
EPP	endpoint protection platform
ER	entity relationship
ERP	enterprise resource planning
ESB	enterprise service bus
ESP	event stream processing
ETL	extraction, transformation and loading
FASB	Financial Accounting Standards Board
FDA	Food and Drug Administration (U.S.)
FMS	financial management system
FORTRAN	Formula Translator
FSM	field service management
FSP	field service provider
FTP	File Transfer Protocol
GAAP	generally accepted accounting principles
GIS	geographic information system
GPS	Global Positioning System
GTM	global trade management
GUI	graphical user interface

HAM	hardware asset management
hcaPaaS	high-control application platform as a service
HCM	human capital management
HDD	hypothesis-driven development
HIP	hybrid integration platform
HIPS	host-based intrusion prevention system
HL7	Health Level Seven International
hpaPaaS	high-productivity application platform as a service
HR	human resources
HRSM	human resources service management
HSM	hardware security module
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
I&O	infrastructure and operations
I/O	input/output
IAST	interactive application security testing
IBN	intent-based networking
iBPMS	intelligent business process management suite
ICM	incentive compensation management
IDE	integrated development environment
IDP	intelligent document processing
IFRS	International Financial Reporting Standards
IGA	identity governance and administration
IM	instant message
IMDG	in-memory data grids
IoT	Internet of Things

IoT PaaS	Internet of Things platform as a service
IP	Internet Protocol
iPaaS	integration platform as a service
IRM	integrated risk management
iSaaS	integration software as a service
ISV	independent software vendor
ITAD	IT asset disposition
ITFM	IT financial management
ITIM	IT infrastructure monitoring
ITOM	IT operations management
ITPA	IT process automation
ITSO	IT service orchestration
Java EE	Java Platform, Enterprise Edition
JCP	Java Community Process
JMS	Java Message Service
JSON	JavaScript Object Notation
JVM	Java Virtual Machine
KPI	key performance indicator
KVM	Kernel-based Virtual Machine
LAN	local-area network
LCAP	low-code application platform
LI	location intelligence
MAI	mobile app integration
MARTE	Modeling and Analysis of Real-time and Embedded
MCM	multichannel marketing
MDM	master data management

MES	manufacturing execution systems
MFT	managed file transfer
MFTPaaS	managed file transfer platform as a service
ML	machine learning
MOM	message-oriented middleware
MoReq	Modular Requirements for the Management of Electronic Records
MQTT	Message Queue Telemetry Transport
MRO	maintenance, repair and operations
MRP	manufacturing resource planning
MVS	Multiple Virtual Storage
MXDP	multiexperience development platform
NCCM	network configuration and change management
NFM	network fault management
NIST	National Institute of Standards and Technology (U.S.)
NLP	natural language processing
NLQ	natural language query
NSM	network and system management
OFD	online fraud detection
OLTP	online transaction processing
OMG	Object Management Group
OOA&D	object-oriented analysis and design
OOB	out-of-the-box
OPDBMS	operational database management system
ORB	object request broker
OS	operating system
OSS	operations support system

OT	operational technology
OWL	Web Ontology Language
PaaS	platform as a service
PAM	privileged access management
PA-RISC	Precision Architecture Reduced Instruction Set Computer (HP)
PBA	policy-based automation
PDF	Portable Document Format
PM&O	profitability modeling and optimization
PMO	project management office
PPM	project and portfolio management
PRM	partner relationship management
pub-sub	publish-subscribe
R&D	research and development
RAD	rapid application development
RCA	root cause analysis
RDBMS	relational database management system
RDF	Resource Description Framework
REST	Representational State Transfer
RF	radio frequency
RFI	request for information
RFP	request for proposal
RISC	reduced instruction set computer
RMAD	rapid mobile application development
ROI	return on investment
RPA	robotic process automation
RPC	remote procedure call

RUM	real-user monitoring
S&OP	sales and operations planning
SaaS	software as a service
SAM	software asset management
SAN	storage area network
SAST	static application security testing
SCCM	software change and configuration management
SCE	supply chain execution
SCM	supply chain management
SCP	supply chain planning
SDAS	software-defined application service
SDK	software development kit
SDL	Specification and Description Language
SDN	software-defined networking
SDR	sales development representative
SDS	software-defined storage
SEC	Securities and Exchange Commission (U.S.)
SEG	secure email gateway
SFA	sales force automation
SIEM	security information and event management
SLA	service-level agreement
SLC	software life cycle
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SOA	service-oriented architecture
SOAP	Simple Object Access Protocol

SOHO	small office/home office
SPM	sales performance management
SPP	service parts planning
SQL	Structured Query Language
SRM	storage resource management
SSO	single sign-on
SWG	secure web gateway
SWIFT	Society for Worldwide Interbank Financial Telecommunication
SysML	Systems Modeling Language
TDD	test-driven development
TDM	test data management
the Fed	U.S. Federal Reserve
TMS	transportation management system
TPM	transaction processing monitor
TSP	technology and service provider
UC	unified communications
UI	user interface
UML	Unified Modeling Language
URL	uniform resource locator
UX	user experience
VAN	value-added network
VAR	value-added reseller
VCA	virtual customer assistant
VDI	virtual desktop infrastructure
VDIM	virtual desktop infrastructure monitoring
VERS	Victorian Electronic Records Strategy

VM	virtual machine
VMM	virtual machine monitor
VMS	Virtual Memory System
VoC	voice of the customer
VoE	voice of the employee
VoIP	voice over Internet Protocol
VRM	vendor risk management
VRP	Vendor Revenue Profile
WAF	web application firewall
WAN	wide-area network
WCM	web content management
WEM	workforce engagement management
WFO	workforce optimization
WMS	warehouse management systems
WNM	wireless network monitoring
WSC	workstream collaboration
XAI	explainable artificial intelligence
XML	Extensible Markup Language
xPaaS	various types of platform as a service

Document Revision History

[Market Definitions and Methodology: Software - 21 July 2020](#)

[Market Definitions and Methodology: Software - 11 April 2019](#)

[Market Definitions and Methodology: Software - 13 February 2018](#)

[Market Definitions and Methodology: Software - 24 January 2017](#)

[Market Definitions and Methodology: Software - 18 February 2016](#)

[Market Definitions and Methodology: Software - 20 January 2015](#)

[Market Definitions: Software - 23 January 2014](#)

[Market Definitions: Software - 21 December 2012](#)

[Market Definitions: Software - 12 January 2012](#)

[Market Definitions: Software - 22 December 2010](#)

[Dataquest Guide: Software Market Research Definitions - 23 December 2009](#)

Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

[Market Definitions and Methodology: Servers](#)

[Market Definitions and Methodology: IT Services](#)

[Market Definitions and Methodology: Integrated Systems](#)

[Market Definitions and Methodology: Enterprise Network Equipment](#)

[Market Definitions and Methodology: Public Cloud Services](#)

[Market Definitions and Methodology: Vertical Industries](#)

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Table 1: License-Type Matrix

	Length of Term	Includes Updates
Perpetual	Forever	No
Term	Term	No
Appliance	Forever	Varies
Open Source	Forever	Varies

Note: If the vendor's licensing model, managerial accounting and investor reporting practices do not match up to Gartner's definitions, then additional adjustments may need to be made to estimate the software and hardware revenue according to those definitions. To better serve clients, Gartner is constantly seeking to provide the best and most current software industry analysis possible. As vendors modify and evolve licensing and pricing models to achieve a competitive edge, Gartner reviews and revises its models and rules to keep up with industry practices.

Source: Gartner (June 2021)

Table 2: Description of Subscription (Excluding Cloud)

	Length of Term	Includes Updates
Subscription	Term	Yes

Source: Gartner (June 2021)

Table 3: Analytics Platforms Market Overview

Analytic Platforms				
Business Intelligence (BI) Platforms	AI and Data Science Platforms	Location Intelligence Platforms	ABI Custom Applications	Other Analytic Platforms Software
<div><div></div> Analytics and BI Platforms</div> <div><div></div> Enterprise Reporting Platforms</div>				

Source: Gartner (June 2021)

Table 4: Customer Relationship Management Market Overview

Customer Experience and Relationship Management				
Customer Service and Support	Digital Commerce	Marketing	Sales	Cross-CRM
<ul style="list-style-type: none"> ■ Digital Customer Service ■ Customer Engagement Center ■ CCI and CCaaS ■ Workforce Engagement Management ■ Field Service Management 	<ul style="list-style-type: none"> ■ Digital Commerce Platforms ■ Digital Commerce Ecosystem Applications 	<ul style="list-style-type: none"> ■ Lead Management ■ Account-Based Marketing ■ Multichannel Marketing ■ Digital and Ad-Tech ■ Loyalty Management ■ Web Content Management 	<ul style="list-style-type: none"> ■ Sales Force Automation ■ Sales Acceleration ■ Partner Relationship Management ■ Sales Enablement ■ Configure, Price and Quote ■ Price Optimization ■ Sales Performance Management ■ Recurring Revenue Management ■ Customer Success 	<ul style="list-style-type: none"> ■ Customer Data Platform ■ Voice of the Customer

Source: Gartner (June 2021)

Table 5: Enterprise Resource Planning Market Overview

Enterprise Resource Planning			
Enterprise Asset Management	Financial Management Systems	Human Capital Management	Manufacturing and Operations
<ul style="list-style-type: none"> ■ Record Assets ■ Capital Construction ■ Planned Maintenance of Assets ■ Reactive Work Management ■ Disposal of Assets ■ Maintenance, Repair and Operations Materials Management ■ Resource Scheduling ■ Condition Monitoring ■ Mobile Workforce Support ■ Reliability-Centered Maintenance 	<ul style="list-style-type: none"> ■ Core Financial Applications ■ Cash and Treasury Management ■ Budgeting, Planning and Forecasting ■ Other FMSs 	<ul style="list-style-type: none"> ■ Administrative HR ■ HR Service Management ■ Talent Management ■ Workforce Analytics ■ Emerging HR ■ Workforce Management ■ Employee Expense Management ■ Other HR Functions 	<ul style="list-style-type: none"> ■ Production Planning and Scheduling ■ Production Operations and Control ■ Manufacturing Information Management

Source: Gartner (June 2021)

Table 6: Supply Chain Management Market Overview

Supply Chain Management		
Supply Chain Planning	Supply Chain Execution	Procurement and Sourcing
<ul style="list-style-type: none"> ■ Demand Planning ■ Inventory Optimization ■ Production and Distribution Planning ■ Sales and Operations Planning ■ Service Parts Planning ■ Strategic Network Design ■ Supply Chain Performance Management/Analytics 	<ul style="list-style-type: none"> ■ Distributed Order Management ■ Warehouse Management System ■ Transportation Management System ■ Global Trade Management 	<ul style="list-style-type: none"> ■ Accounts Payable Invoice Automation ■ Contract Life Cycle Management ■ E-Procurement ■ E-Sourcing ■ Procurement Networks ■ Services Procurement ■ Spend Analytics ■ Supplier E-Invoicing ■ Supplier Management

Source: Gartner (June 2021)

Table 7: Application Development Market Overview

Application Development		
Plan	Create	Verify
<ul style="list-style-type: none"> ■ adPaaS ■ Enterprise Agile Planning Tools <ul style="list-style-type: none"> ■ Frameworks ■ Requirements Definition and Management ■ Product Roadmapping Tools ■ Conversational User Interfaces ■ Design <ul style="list-style-type: none"> ■ Continuous Experience ■ Event-Driven Programming Models ■ Mediated API ■ API Economy ■ Database Design ■ Object-Oriented Analysis and Design ■ UX Tools Other ADLM 	<ul style="list-style-type: none"> ■ Build <ul style="list-style-type: none"> ■ Event-Driven Web ■ Agile Development ■ Behavior-Driven Development ■ Hypothesis-Driven Development ■ Multiexperience Development Platforms (MXDP) ■ Citizen Automation and Development Platform (CADP), Rapid Application Development (RAD) and Rapid Mobile Application Development (RMAD) ■ Code <ul style="list-style-type: none"> ■ Java Platform AD Tools ■ Microsoft .NET Platform AD Tools ■ Language-Oriented Development Environments ■ Dynamic Web Application Tools 	<ul style="list-style-type: none"> ■ Automated Testing ■ Cloud Testing ■ DevOps Application Testing ■ Quality Engineering ■ Service-Oriented Architecture Testing ■ Test Data Management ■ Application Development Mainframe Tools ■ Other AD

- Post-Scrum Methodologies
 - Intelligent Device Development Tools
 - Public Web APIs
 - Reactive Programming
- Configure
 - Application Portfolio Management

Source: Gartner (June 2021)

Table 8: Application Infrastructure and Middleware Market Overview (1)

Application Infrastructure and Middleware (1)				
Transaction Processing Monitors	Application Platforms Software	Event Stream Processing (ESP) Platforms	High-Productivity Application Platform as a Service (hpaPaaS)	High-Control Application Platform as a Service (hcaPaaS)
	<ul style="list-style-type: none"> ■ Application Servers ■ Cloud-Enabled Application Platforms ■ In-Memory Data Grids 			<ul style="list-style-type: none"> ■ Function PaaS (Serverless)

Source: Gartner (June 2021)

Table 9: Application Infrastructure and Middleware Market Overview (2)

Application Infrastructure and Middleware (2)				
Application Integration Suites	B2B Gateway Software (Stand-Alone)	Integration Platform as a Service (iPaaS)	Full Life Cycle API Management	Event Brokers and Messaging Infrastructure
		■ iSaaS		<ul style="list-style-type: none"> ■ High-Performance Message Infrastructure ■ Cloud Message Broker Services

Source: Gartner (June 2021)

Table 10: Application Infrastructure and Middleware Market Overview (3)

Application Infrastructure and Middleware (3)				
MFT Suites	Business Process Management Suites	Robotic Process Automation	Digital Experience Platforms	Other AIM
■ Cloud Managed File Transfer Services	■ Cloud Business Process Management Services	■ RPA PaaS	■ Cloud Digital Experience Platform Services	■ Adapters ■ BPA Tools ■ BPM Platforms (non-BPMS) ■ BRE Software ■ IoT Platforms (AIM Components) ■ Cloud IoT Platform Services (IoT PaaS) ■ Object Request Brokers ■ EDI/B2B Value-Added Networks ■ Process Discovery ■ Process Mining ■ Miscellaneous Middleware Components

Source: Gartner (June 2021)

Table 11: Data Management Software (Excluding DBMS) Overview

Data Management Software (Excluding DBMS)				
Data Integration Software	Data Quality Software	Master Data Management Software	Metadata Management Software	Other Data Integration Software

Source: Gartner (June 2021)

Table 12: Database Management Systems

Database Management Systems		
Nonrelational DBMS	Prerelational-era DBMS	RDBMS

Source: Gartner (June 2021)

Table 13: IT Operations Management Software Market Overview

IT Operations Management Software				
Delivery Automation	Experience Management	Performance Analysis	ITOM Mainframe Tools	Other ITOM
■ Application Release Orchestration	■ I&O Business Value Dashboards	■ Artificial Intelligence for Operations		
■ Cloud Management Platforms	■ IT Financial Management	■ Application Performance Monitoring Suites		
■ Cloud Migration Tools	■ IT Service Management	■ Capacity Planning and Management Tools		
■ Container Management	■ Software Asset Management	■ Digital Experience Monitoring		
■ Continuous Configuration Automation	■ IT Asset Management	■ Dynamic Optimization Technology		
■ Continuous Delivery		■ IT Event Correlation and Analysis Tools		
■ DevOps Toolchain Orchestration		■ IT Infrastructure Monitoring		
■ Heuristic I&O Automation		■ Network Fault Management		
■ Hybrid Cloud Computing		■ Network Performance Monitoring and Diagnostics		
■ IT Process Automation				
■ IT Service Orchestration				
■ IT Workload Automation				
■ Network Automation				

- Server Automation
- Unified Communications Monitoring Tools
- Other Automation Tools
- Wireless Network Monitoring Tools
- Virtual Desktop Infrastructure Monitoring
- Other Monitoring Tools

Source: Gartner (June 2021)

Table 14: Operating Systems Market Overview

Operating Systems			
UNIX	Linux	Windows	Others
■ IBM AIX	■ Red Hat	■ Windows Client	■ System z/OS
■ HP-UX	■ SUSE	■ Windows Server	■ Other OSs
■ macOS	■ Canonical (Ubuntu)		
■ Other UNIX	■ Oracle Linux		

Source: Gartner (June 2021)

Table 15: Security Software Market Overview (1)

Security Software (1)				
Integrated Risk Management	Application Security	Consumer Security Software	Infrastructure Protection	Identity Access Management
	<ul style="list-style-type: none"> ■ Application Security Testing ■ Vulnerability Assessment ■ Web Application Firewall 		<ul style="list-style-type: none"> ■ Endpoint Protection Platforms (Enterprise) ■ Secure Email Gateways ■ SIEM Software ■ Secure Web Gateways ■ Threat Intelligence 	<ul style="list-style-type: none"> ■ Identity Governance and Administration ■ Access Management ■ Privileged Access Management ■ User Authentication

Source: Gartner (June 2021)

Table 16: Security Software Market Overview (2)

Security Software (2)		
Data Security	Cloud Access Security Brokers	Other Security Software
<ul style="list-style-type: none"> ■ Enterprise Data Loss Prevention ■ Encryption ■ Tokenization 		

Source: Gartner (June 2021)

Table 17: Storage Software Market Overview

Storage Management Software				
Archive	Backup and Recovery	Software-Defined Storage	Storage Resource Management	Other Storage Software

Source: Gartner (June 2021)

Table 18: Virtualization Infrastructure Software Market Overview

Virtualization Infrastructure Software		
x86 Server Virtualization Infrastructure	Virtual Desktop Infrastructure	Server-Based Computing

Source: Gartner (June 2021)