Evolving Capabilities of Analytics and Business Intelligence Platforms

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Initiatives: Analytics and Artificial Intelligence for Technical Professionals; Evolve Technology and Process Capabilities to Support D&A

Modern analytics and business intelligence platforms are constantly evolving and incorporating niche capabilities to fulfill diverse use cases. This research helps data and analytics technical professionals understand and assess these emerging capabilities while modernizing their analytics platform.

Overview

Key Findings

- The demand for relevant, intuitive and on-demand decision support has eclipsed the capabilities of traditional BI tools. Data-driven organizations are turning to modern A&BI platforms that empower line-of-business users to extract value from data and uncover insights.
- Augmented analytics can jump-start self-service analytics with conversational interfaces, augmented data discovery and advanced analytics — however, these capabilities are still evolving and present operational and data exposure risks.
- Modern A&BI platforms are continually evolving their capabilities, and technical professionals are adopting them in their current and planned A&BI implementations to support advanced and diverse use cases with decreased time to value.

Recommendations

Analytics and BI technical professionals responsible for architecting solutions and incorporating evolving capabilities of new A&BI platforms should:

- Adopt modern A&BI platforms to deliver self-service analytics, increased agility and faster insights — in conjunction with enterprise reporting platforms, as centralized enterprise reporting is still the most widely used capability also being augmented by modern A&BI.
- Deploy augmented data preparation, conversational analytics and automated insight functions in A&BI so that technical professionals spend less time authoring analytics and more time enabling self-service analytics teams and consumers.
- Consolidate aging and overlapping A&BI platforms that are duplicated for use cases and business functions. At the same time, continue supporting diverse A&BI platforms to satisfy the industry-specialized and niche user requirements that are not easily consolidated by embracing collaborative and federated yet governed approaches to A&BI.

Strategic Planning Assumption(s)

By 2025, augmented consumerization functionality will drive adoption of analytics and business intelligence capabilities beyond 50% for the first time, influencing more business processes and decisions.

By 2023, 60% of organizations will compose components from three or more analytics solutions to build business applications infused with analytics that connect insights to actions.

By 2025, 80% of analytics products will feature a conversational interface — up from 50% today.

Analysis

This document was republished on 9 May 2022. The document you are viewing is the corrected version. For more information, see the Corrections page on gartner.com.

Introduction

Analytics, the core of the digital business, is not a capability that line of business (LOB) users are willing to wait for. Throughout the organization, information is a requirement to justify decision making. Access to information leads to insight and competitive advantage. As a result, most IT organizations face an urgent requirement to broaden information access by expanding analytics and business intelligence (A&BI) self-service analytics capabilities.

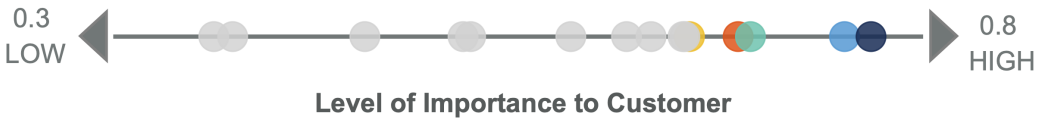
To meet these increasingly ambitious time-to-insight demands, the traditional BI model must evolve. Platforms must become easier to use by business analysts and support the complexity demanded by citizen data scientists. Datasets must become accessible more quickly and insights need to be shared via multiple channels and digital-workplace tools. The modern A&BI platform is characterized by agility, flexibility and ease of use throughout every phase of the analytics workflow.

Content authoring is gradually becoming the responsibility of business users, business technologists and business analysts instead of BI developers. Descriptive reports and dashboards, while still required, are being complemented by new approaches in the diagnostic, predictive and prescriptive realm. These include interactive data exploration via interactive data visualizations, augmented analytics and advanced analytics.

To keep up with user demand, A&BI platforms must evolve with new capabilities. Figure 1 illustrates the paradigm shift in drivers of product satisfaction in A&BI Platforms. End users have ranked analytics catalogs, advanced analytics, Natural language query (NLQ), Natural language generation (NLG) and automated insights as the most sought after capabilities in A&BI platforms. Many of these analytical capabilities are provided by modern &BI tools — although, in the case of machine learning/predictive analytics and prescriptive analytics/optimization — the foundational capabilities provided by modern analytics and BI platforms must be augmented with data science platforms. This has even led to quite a few acquisitions of augmented analytics tools by large A&BI platforms. Modern A&BI platforms, which incorporate many of these important capabilities, should be part of your data and analytics strategy.

A&BI technical professionals should investigate the gaps in their current incumbent products that prevent wider adoption and determine if a best-of-breed approach — where they invest in one or more of these evolving capabilities, along with their incumbent — results in a better overall solution. This research assesses some of these capabilities along with breaking down the value proposition they hold while considering the transformation needed to leverage them.

Figure 1: Drivers of Product Satisfaction in Analytics and Business Intelligence Platforms



Components	Importance
Catalog	0.72
Advanced Analytics	0.71
Natural Language Query	0.66
Natural Language Generation	0.66
Automated Insights	0.63
Data Visualization	0.63
Data Preparation	0.63
Model Complexity	0.62
Data Storytelling	0.60
Embedded	0.58
Manageability	0.53
Reporting	0.52
Data Source Connectivity	0.47
Cloud	0.41
Security	0.40

Base: 870 enterprise reviews for all vendors in Analytics and Business Intelligence (ABI) Platforms market published on Gartner Peer Insights between March 2020 and February 2021. Reviewers' satisfaction ratings (on a scale of 1 to 5) on Peer Insights product capabilities have been used to derive the importance score. Capabilities have been sorted in a descending order based on these importance scores. Data is reviewer opinion during a snapshot in time and does not represent the market.
Source: Gartner

Gartner

Modern Analytics and BI

Figure 2, although not intended to be prescriptive, illustrates the components that would be expected to be found in the technical architecture of a modern, self-contained BI platform.

1. The modern BI platform connects to diverse data sources, such as relational, Hadoop, semistructured, NoSQL, APIs and flat files.

2. Upfront modeling is not required for loading datasets. Although users can take advantage of IT-enabled datasets or, for prototyping or hypothesis-testing purposes, they can develop their own data model.

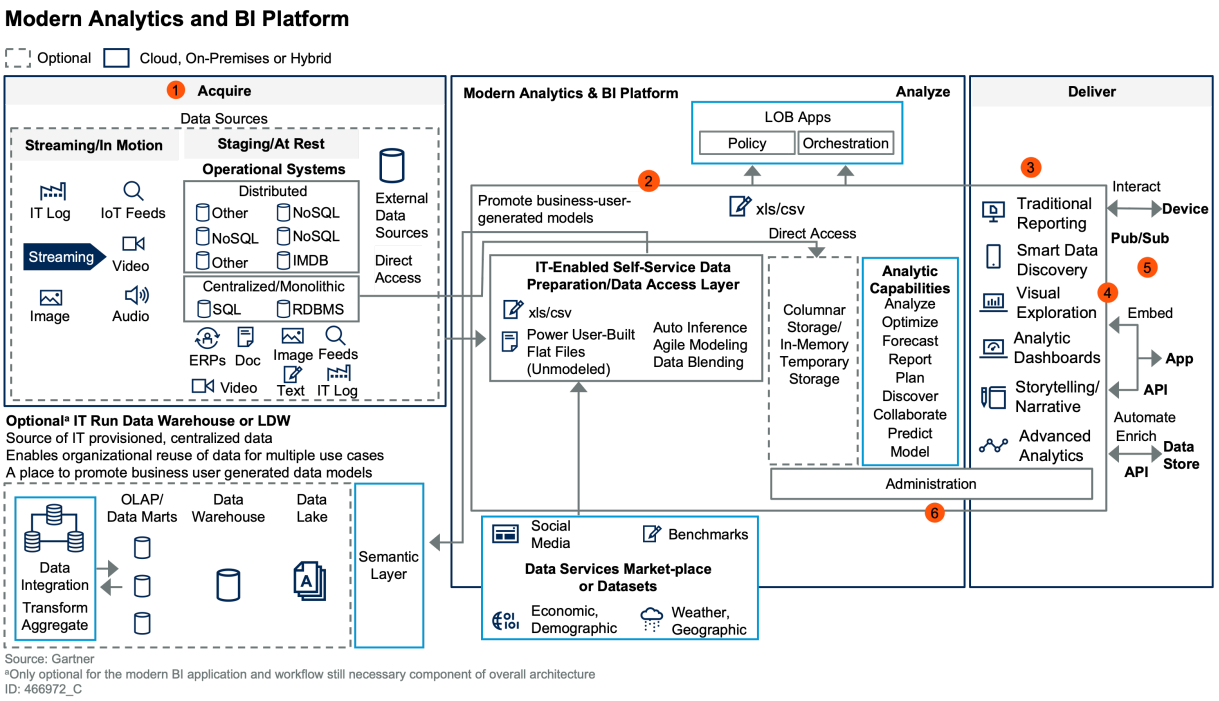
3. Using these datasets, content producers such as power users in the business can create their own content, whether it be reports, dashboards, data visualizations, data stories or compose analytics applications.

4. Users gain powerful and dynamic analysis capabilities, including data-discovery-driven advanced analytical capabilities and natural language query and generation.

5. Users can take advantage of varied sharing and collaboration capabilities with internal team members within the platform's social user interface, the broader organization in digital-workplace tools and external users through chatbots and embedded analytics.

6. IT gains granular capabilities to restrict or enable self-service and data access. This can allow agility while still being in accordance with regulatory/governance policies and procedures, as well as the capability to effectively manage BI platforms in on-premises and cloud environments.

Figure 2: Modern A&BI Platform



As can be seen in Figure 2, the self-contained modern A&BI platform does not have the rigidly defined semantic layer that you would observe in a traditional enterprise reporting platform. Modern BI operates with its own semantic logic that is often automatically generated through augmented data modeling, which has its pros and cons. An automatically generated semantic layer not only allows for datasets to be imported by the power user for more agile analysis and content development, but also introduces data consistency risks. Some D&A technology professionals choose to turn it off to avoid propagation of automated errors.

This is also where “just enough organize” comes into play in Figure 2. The self-contained modern BI platform can be used to bring in datasets and allow users to execute prototyping analysis or, in some cases, to serve as an end-to-end data platform and replace data warehousing capabilities. However, in both cases, these modern platforms are designed to deliver these capabilities for quick, easily used analytics rather than governed, consistently modeled data that delivers a single source of truth. Using a modern platform for full end-to-end analytical purposes exposes the organization to the risk of developing analytical silos — which may lead to further challenges when implementing additional or migrating into other A&BI platforms.

Examples of some modern A&BI platforms, with respect to their traditional enterprise reporting predecessors, are included in Table 1. If you need the capabilities of a modern A&BI platform integrated into a single suite, you should look at the offerings from one of those vendors, or onboard niche players that provide these capabilities separately. Generally speaking, these products are differentiated by their delivery model (i.e., SaaS, on-premises or hybrid), as well as the breadth and depth of their analytics and visualization capabilities.

Table 1: Traditional Enterprise Reporting to Modern A&BI

Traditional Enterprise Reporting Platform	Modern Analytics and BI Platform with Augmented Analytics
IBM Cognos Business Intelligence 10.x	IBM Cognos Analytics 11.x
Microsoft Analysis Services/SQL Server Reporting Services	Microsoft Power BI
Oracle Business Intelligence Enterprise Edition (OBIEE)	Oracle Analytics Server (OAS) and Oracle Analytics Cloud (OAC)
QlikView	Qlik Sense
SAP BusinessObjects - Web Intelligence (WebI), SAP Crystal Reports, SAP BusinessObjects Design Studio (SAP BusinessObjects Lumira 2.0)	SAP Analytics Cloud
TIBCO Jaspersoft	TIBCO Spotfire

Source: Gartner (April 2022)

Some A&BI vendors blur the distinction between these two spaces with integrated products and capabilities. Some vendors that are providing capabilities across both categories include Infor Birst, Board, GoodData, Hitachi Vantara (Pentaho), Pyramid Analytics, insightsoftware (Logi Analytics), Tableau (Ask/Explain Data and Einstein Discovery), Yellowfin and IBM Cognos Analytics 11.x.

For more information on the vendors in the modern A&BI landscape, see:

- Demystifying the Analytics and BI Space
- Market Guide for Augmented Analytics Tools

Evolving Capabilities of Analytics and BI

Analytics & BI vendors are continually transforming the way insights are explored, discovered and delivered. Along with that, the adoption of augmented analytics and a paradigm shift in the typical personas in the A&BI space has further led to fusion roles like business technologists, citizen data scientists and business analytics developers. This will lead to the future of the analytics and BI user experience being consumer-focused and dynamic, augmented and in context, conversational, open to other tools — including data science and machine learning modeling — and embedded in applications, as stated in Top Trends in Data and Analytics for 2021: The Rise of the Augmented Consumer.

A&BI technical professionals need to stay on top of these trends, and the growing demands of data savvy and literate business technologists. They should assess these evolving capabilities in the A&BI platform market and take a build versus buy versus customize decision. This section discusses some of these capabilities based on popularity of adoption and value proposition. Each capability has been divided into description, impact on your current ecosystem and how to strategize enabling it.

Augmented Analytics for an Automated Advanced Analytics Workflow

Description

Many Gartner clients are well-aware of the vast and diverse market for A&BI. They are looking for differentiation, and want to know what key areas of innovation are driving BI platform evolution. This is where augmented analytics come into the picture.

> **Augmented Analytics**
>
> Gartner defines “Augmented Analytics” as the use of enabling technologies, such as machine learning and AI to assist with data preparation, insight generation and insight explanation to augment how people explore and analyze data in A&BI platforms. [1]

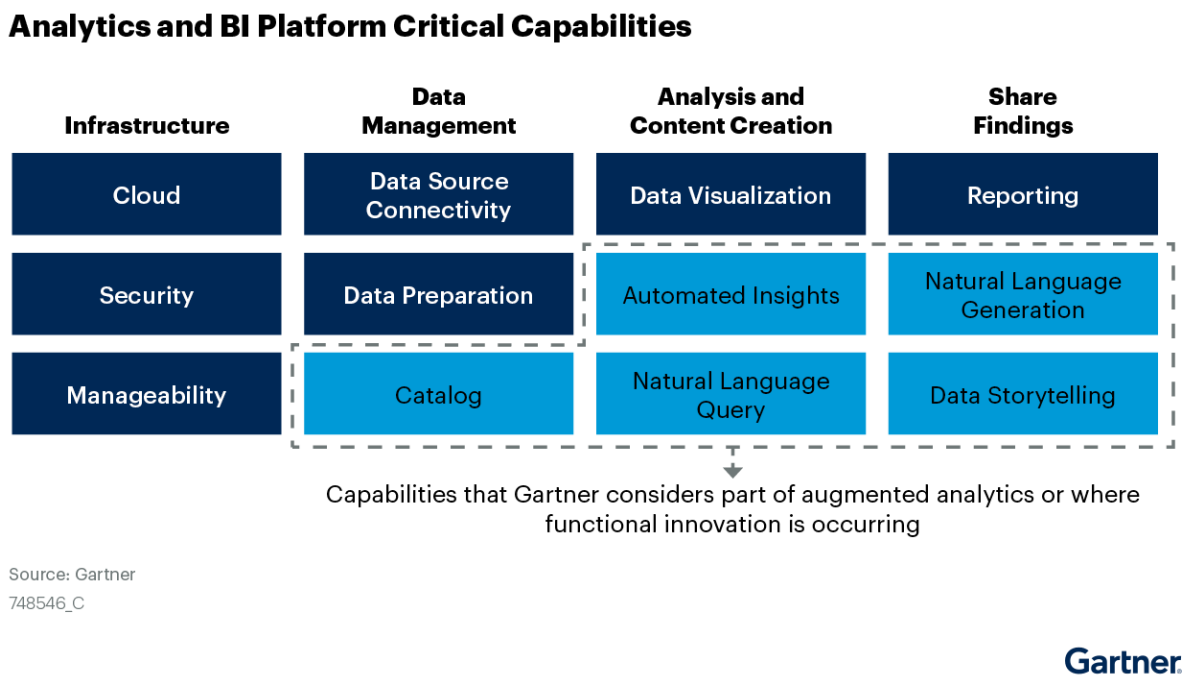
It also augments the expert and citizen data scientists by automating many aspects of data science, machine learning, and AI model development, management and deployment.

Rather than stand-alone platforms, augmented analytics refer to features in three categories that augment and supplement capabilities in both modern and traditional BI platforms:

- Augmented data preparation uses machine learning automation to augment data profiling and data quality, harmonization, modeling, manipulation, enrichment, metadata development and cataloging.
- Augmented data discovery (formerly “smart data discovery”) enables business analysts and citizen data scientists to use machine learning to automatically find, visualize and narrate relevant findings, such as correlations, exceptions, clusters and links, without building models or writing algorithms. Users explore data via visualizations, search and natural language query technologies, supported by natural-language-generated narration for interpretation of results. It can be used by citizen data scientists to analyze data without preconceived notions for early prototyping and hypothesis testing with less manual experimentation. Consequently, skilled data scientists have more time to focus on building and operationalizing the most relevant models.
- Augmented data science and machine learning automates key aspects of advanced analytics modeling, such as feature selection. This reduces the requirement for specialized skills to generate, operationalize and manage advanced analytics — especially in a manner that delivers predictive or prescriptive guidance.

Figure 3 below shares the Critical Capabilities of A&BI platforms which fall under the Augmented Analytics umbrella and which should be explored to advance your current A&BI landscape.

Figure 3: A&BI Platform Critical Capabilities

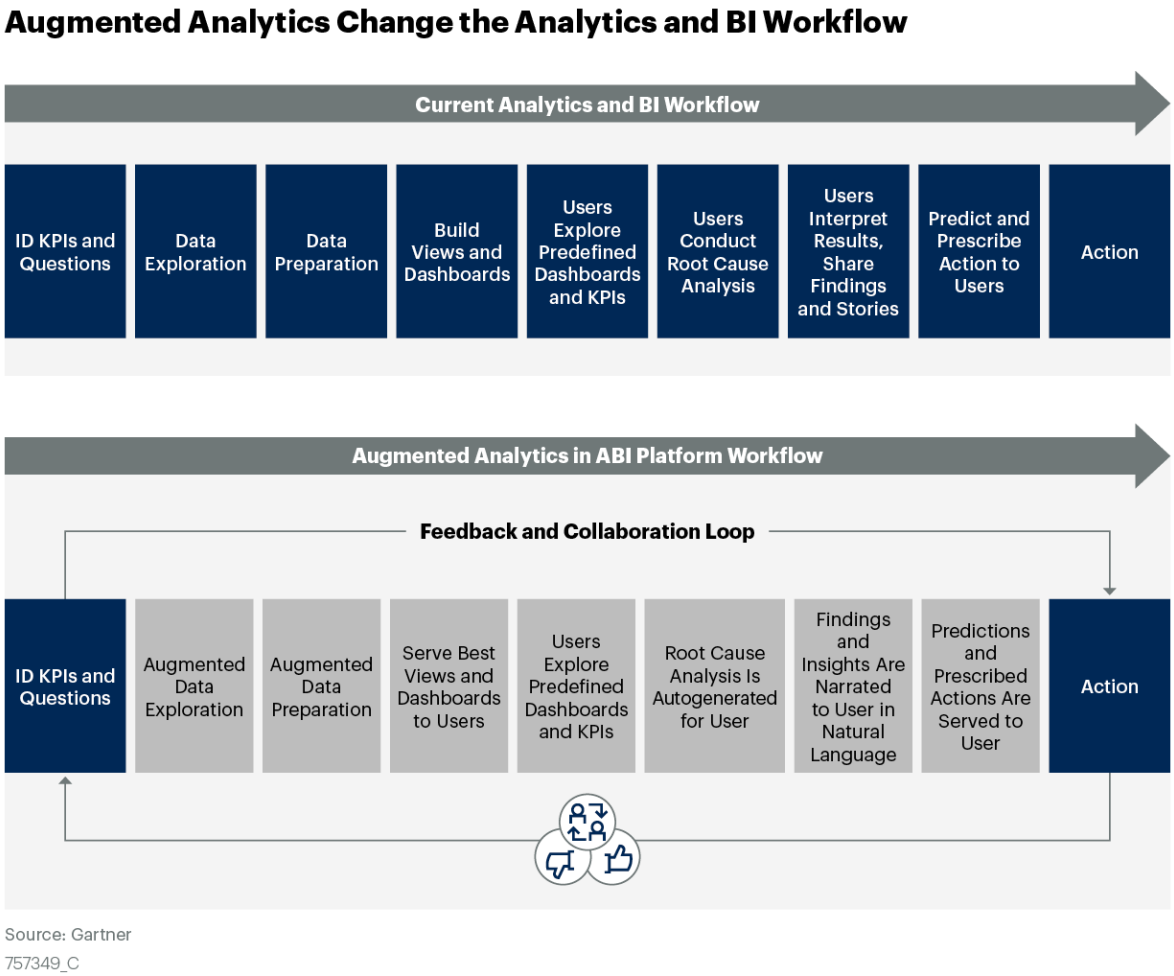


Impact

Augmented analytics capabilities have made modern BI platforms — which in most organizations are an amalgamation of multiple tools — far more capable of empowering larger numbers of business users to quickly execute more robust, more sophisticated analytics. As shown in Figure 4, augmented analytics impact the end-to-end A&BI workflow. From transforming the way we prepare data for analytics to how we deliver insights and everything in between is drastically automated, tremendously reducing time to value for A&BI. However, with such an automated workflow comes the caution of transparency and accuracy, and ensuring that the underlying models are trustworthy with minimal human intervention.

Augmented analytics capabilities are proliferating. The capabilities of natural language generation/processing/query, conversational chatbots and augmented reality have spread into the rest of the analytics stack. These AI/ML-based functions contribute to the democratization of analytics by making advanced capabilities more easily accessible to business users. These capabilities, though a part of the augmented analytics umbrella, are discussed in the next section.

Figure 4: Augmented Analytics Across the A&BI Workflow

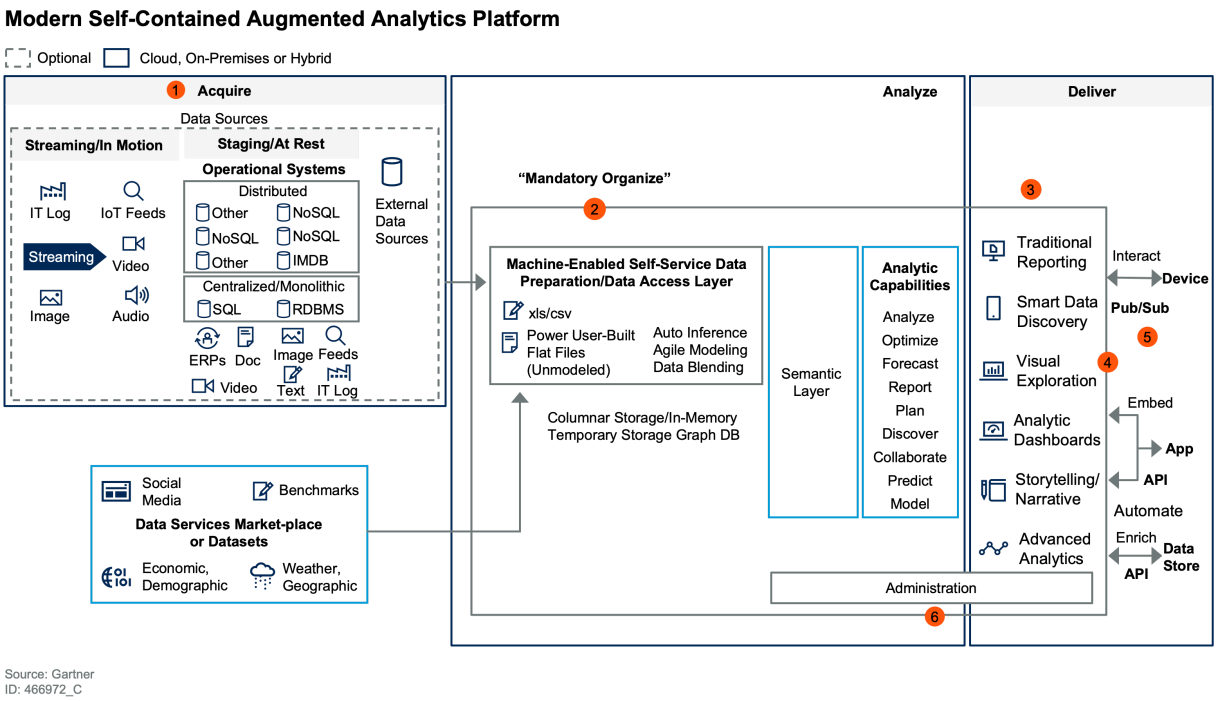


Enable

Augmented analytics is less a single product than a collection of features that are integrated into the rest of the analytics product landscape. In a particular space, the most advanced applications in terms of their adoption of multiple augmented capabilities, confusingly, are often referred to as “augmented analytics platforms.” However, as these capabilities commoditize, most organizations will eventually own an analytics product with augmented analytics capabilities “baked in.”

Adding to the confusion, augmented analytics come in many shapes and sizes. Some products, such as ThoughtSpot, MicroStrategy and Infor Birst, have integrated their augmented analytics functions into a self-contained augmented analytics platform. These functions typically require the establishment of a semantic layer of well-understood data that is typically hosted inside the platform. These are depicted in Figure 5.

Figure 5: Modern Self-Contained Augmented Analytics Platform



Source: Gartner
ID: 466972_C

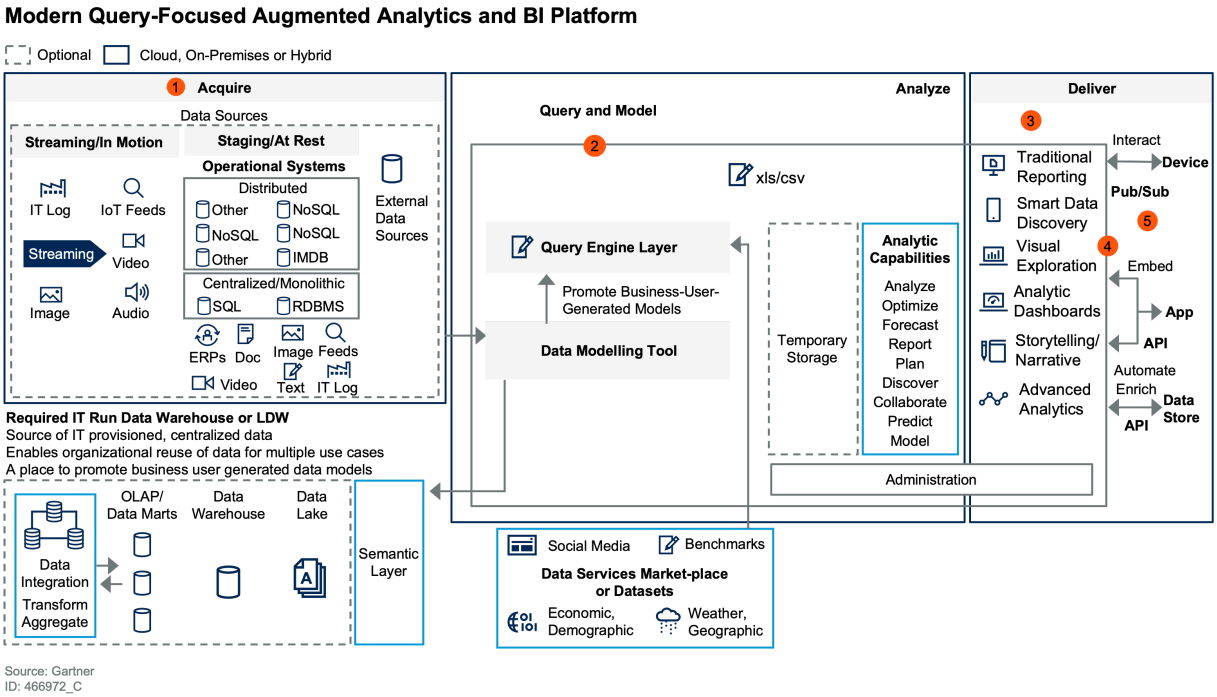
Gartner

In this architecture, you can see that the defining feature is in Step 2, when data is organized into a machine learning enabled self-service data preparation/data access layer. This typically leverages high performance infrastructure, which could include in-memory, massively parallel processing (MPP), cloud-hosted and/or columnar databases, such that analytics can be run on top of this optimized storage layer. These products focus on collecting data. Because of the investment that they make in collecting data and giving it meaning, they can provide augmented analytics that focus more on answering "why" questions, and joining disparate datasets together to deliver insights with little user manipulation or tuning.

Other products, especially products either built to connect to large datasets, for cloud deployment or for embedding, do not place as much emphasis on collecting data; they focus more on connecting to data. A&BI products with augmented capabilities, such as Looker and AnswerRocket, take the approach of connecting to data and running augmented analytics functions — which typically makes this query interface more attractive. As a result, these A&BI tools tend to have stripped-down functions for 'augmented analytics' generation of visualizations and insights, but strong natural language query functions (see Figure 6).

The defining features of such platforms include the query-focused augmented A&BI platforms integrating into a data warehouse or LDW ecosystem, on-premises or in the cloud, and the data modeling and query engine layer that they put into place (see Figure 6). Fast storage is a less defining component of these platforms, as they are dependent on the performance characteristics of the underlying data sources, for better or for worse. This form of augmented analytics solutions have been further discussed in the next section around conversational platforms.

Figure 6: Modern Query-Focused Augmented A&BI Platform



Complicating matters further, the large A&BI vendors, such as Microsoft Power BI, Oracle, IBM, Qlik, SAP and Salesforce (Tableau), have built capabilities in both realms. They offer augmented analytics interfaces that can create an easy-access query layer for data that is live-connected to data sources (usually within their own vendor stack), and in-memory storage capabilities connected to enhanced analytics insights and data visualizations.

Depending on the mode that you choose to deploy these platforms, technical professionals face different challenges. Query-based augmented approaches scale very well, and integrate nicely with investments at the data lake and data warehouse layer — but they often offer inferior analytics insight generation. Self-contained augmented analytics often force customers to consider moving a lot of their data into these platforms, even if this causes performance trade-offs or redundancy with data warehouse investments.

Note that this market is growing quickly with new vendor entrants. For more information about augmented analytics vendors and capabilities, see Using Augmented Analytics to Boost A&BI and Market Guide for Augmented Analytics Tools

Conversational Interfaces in A&BI Platforms

Description

One of the strongest use cases for augmented analytics is to provide a broader set of interfaces to users. With the power of a conversational platform behind it, augmented analytics provides multiple enhancements, including:

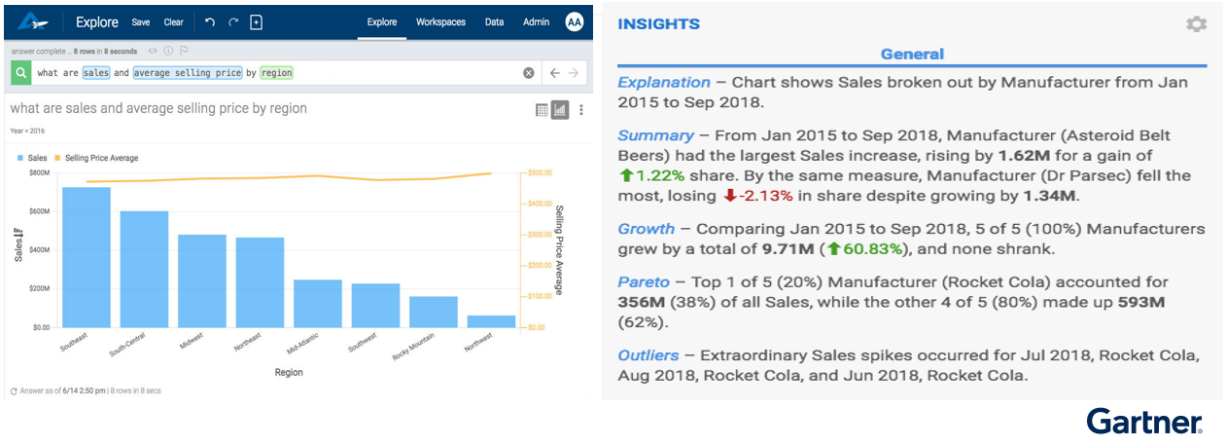
- Chatbots
- Natural language generation (NLG) of text (i.e., describe the importance of the insights in natural language, storytelling)
- Natural language query (NLQ) on data (i.e., asking questions via search or voice in natural language)
- The creation of visualizations using natural language commands
- The ability to connect to an audio interface like Amazon Alexa, or to a collaboration platform like Slack or Teams — or even AR-based story narration

Typically, most of these capabilities have a foundation of NLP, ML and AI to make interactions with data conversational and communicate insights conversationally too. These include A&BI platforms like ThoughtSpot, AnswerRocket, Looker, Yellowfin, Narrative Science (Lexio), which embrace these capabilities and contextualize them for analytics use cases. How they are impacting the disruption in the A&BI space is discussed in the next section.

Impact

Natural language processing (NLP) is revolutionizing how we interact with machines and is popping up in every business application. These capabilities enable users to cut short laborious, menu-driven processes and jump straight to the information they are looking for and, hence, reshape the data management and analytics landscape. A&BI applications are now providing a way to ask direct questions like, “What were my company’s sales for the last quarter?,” rather than following a menu-driven app interface to retrieve information. Further, key drivers and highlights of complicated analytics are now being shared as automated insights or story snippets in natural language to easily make businesses understand what they are looking at, without having to decipher complicated charts. NLP as a technology is becoming part of our daily lives by making us move away from using GUI-based interfaces to a more personal, human language interaction with data and applications. With the combination of technical innovation and faster computing frameworks and infrastructure, technology is now catching up to the academic advancements in analyzing human language, be it text or speech. An example of how a natural language query can yield insights and visualizations, and further how natural language generation can share findings cohesively, is shared in Figure 7.

Figure 7: Natural Language Understanding (NLU) and Natural Language Generation (NLG) in A&BI Platforms



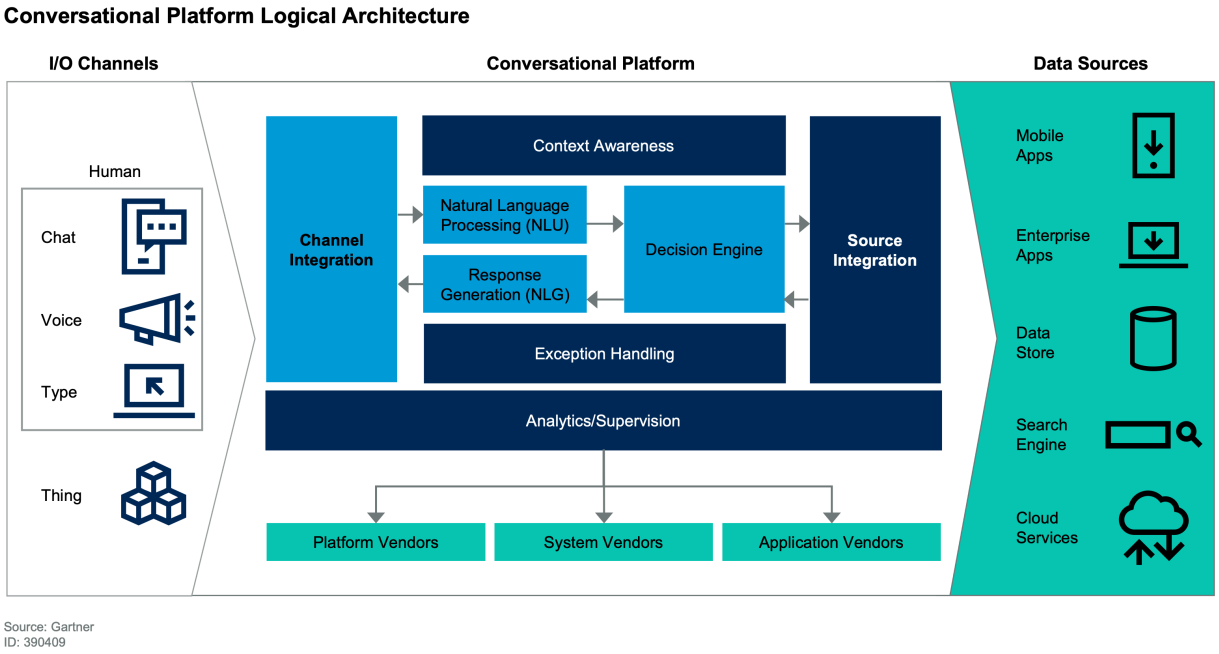
Source: AnswerRocket

This now allows business users or technologists to ask questions beyond the analysis and reporting of structured data. Furthermore, they can now find relationships across structured, unstructured and semistructured data — with little analytics or query language skill. This is possible due to the way the data has to be structured and fed into these conversational platforms for A&BI. Metadata management and cataloging of data become essential for successful implementation of such capabilities. Technical professionals interested in adapting these capabilities in their current analytics implementation should consider the factors discussed in the next section.

Enable

Conversational platforms typically leverage an NLP engine under the hood to provide natural language understanding and generation. They typically have pretrained models, which iteratively keep on learning from the data they are fed. They also have feedback loops or need varying levels of human intervention to assist with accuracy and, most importantly, transparency of the insight generation process. Figure 8 below illustrates the logical architecture of a conversational platform. For further details on conversational platforms and insight engines, which leverage NLP, refer to Emerging Use Cases for Natural Language Technology.

Figure 8: Conversational Platform Logical Architecture



Technical professionals interested in leveraging such conversational platforms as part of their current A&BI implementation, or planning to invest in a stand-alone vendor, should consider the following factors:

- Typically, NLP engines require data modeled in a way to achieve analytics at scale. This would typically require the data to be mandatorily organized in ways aligning to the NLP model, as shown in the Figure 5.
- Conversational platforms mostly leverage in memory computing and caching, and are typically compute intensive as compared to traditional BI queries. Hence, appropriate compute resources need to be provisioned to facilitate such workloads.

- Iterative testing of the openness, explainability and interoperability of the NLP models (NLQ and NLU) leveraged by such platforms should be performed to ensure trustworthy adoption — along with preventing proprietary software or models.
- Many of these conversational engines are dependent upon live connections onto the underlying data repository, which may cause clogging of upstream systems, and may also depend on performance of upstream systems.

These considerations could help understand the build versus buy versus customize debate for such capabilities, as many of these capabilities are also being served as extensions or add-ons in mainstream A&BI platforms.

Streaming/Real Time Analytics for Continuous Intelligence

Description

To meet the evolving business demands, A&BI needs to stay ahead of the curve with continuous intelligence and move from a reactive to a proactive approach to analytics. Streaming or real-time analytics applications are sparking an emergence of newer business processes and operating paradigms for operational, prescriptive and predictive analytics. Streaming analytics involves real-time processing of an unbounded, unordered stream of data by applying a series of functions on each data point as it comes. It entails different paradigms for data management and analytics as the analytics and BI components change dynamically with time. To operate in real time, technical professionals need to leverage predefined analytical models rather than ad hoc models, and use current input data rather than just historical data. The time value of data has become an invaluable asset, and continuous intelligence is becoming a mandatory capability in A&BI platforms.

Impact

Streaming analytics can provide a competitive advantage to enterprises by providing a continuous delivery of contextualized information. This improves operational decisions significantly along with being able to contextualize historical analytics models with real-time data to drive continuous intelligence. To move to real time, it is imperative to determine which concept of “real time” is relevant to your business problem. Decisions have a range of natural timing, so the “right time” is not always real time. Any decision can be made quickly if you are willing to sacrifice quality, but the right time for strategic and tactical decisions is never real time. Technical professionals like solution architects should work with the business decision makers to determine how fast to make each decision. The two primary considerations are:

- How quickly will the value of the decision degrade?
    - Decisions should be executed in real time if a customer is waiting on the phone for an answer; resources would be wasted if they sit idle; fraud would succeed; or physical processes would fail if the decision takes more than a few milliseconds or minutes. On the other hand, a decision on corporate strategy may be nearly as valuable in a month as it would today, because its implementation will take place over months and years, so starting a bit earlier may not matter much.

- How much better will a decision be if more time is spent?
    - Simple, well-understood decisions on known topics, and for which data is readily available, can be made quickly without sacrificing quality. However, achieving good quality in a complicated decision may require a longer decision cycle, because:
        - There are many unknowns at the beginning of the process, so analytical models from previous decisions are not applicable. The company must develop a new analytical model, or modify a model from an earlier decision, to fit the situation.
        - No one knows what kind of data will be needed until the decision process is underway. It may take hours or days to gather the relevant data. Real-time data (from the last 15 minutes before the decision is finally made) may be irrelevant to decision quality if the decision depends on long-term trends.
        - Iterative human collaboration and new thought are required.

Thus, based on time to value, decisions can be categorized into four major categories, as discussed below and illustrated in Figure 9.

- Strategic business decisions, such as “Should we acquire a company?” or “Should we expand into a new country?,” require multimonth decision processes that encompass iterative data collection, model building and model execution; and multiple rounds of meetings and emails. It may take only a few seconds to run a particular model once (that is, real-time computation), but multiple models will be run many times during the decision process.

- Tactical decisions, such as “What kinds of customers should be the target market for this product?,” and “What should be our policy for approving mortgages?” have a shorter decision cycle than strategic decisions (see Figure 9). However, they still require multiple rounds of data collection, analytics and discussion.

- Operational decisions may be real-time. Decisions such as “Should we hire this particular person?” and “What should our contact center staffing schedule for next week look like?” are not real time, because they require collaboration among people and multiple rounds of input and thought (although far fewer than strategic and tactical decisions). Analytics, often using real-time computation, improve the quality of these decisions by providing insights that would not be available through manual analysis. However, analytics can’t turn the decisions into real-time decisions because of the lag times in collaboration and the iterations of data collection and analysis that have to be gone through (see A in Figure 9).

- Automated, operational decisions. Some operational decisions that (historically) were not real time can, and should, be made real time through the use of real-time analytics (see B in Figure 9). Examples include:

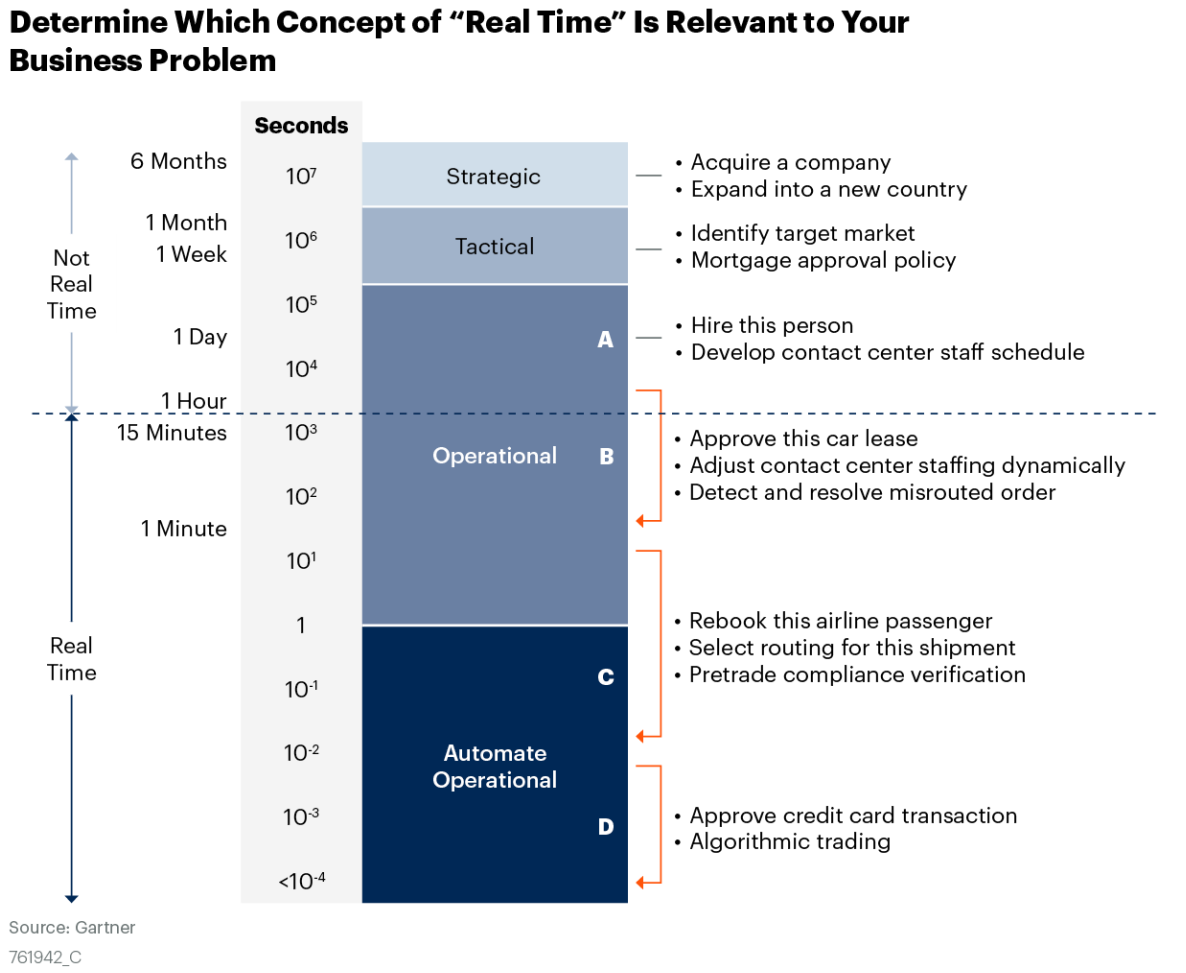
    - The process to approve a car lease that took up to three days can be condensed into a real-time decision with a 15-minute service level target by leveraging real-time analytics.

    - Adjustments to the staffing level of a contact center can become real-time by replacing an hourly or daily report on customer wait times, with a real-time business activity monitoring (BAM) dashboard that is updated every minute.

    - Customer orders that become stuck at a step in a business process can be detected by a real-time process intelligence system within a few minutes, so corrective action can be initiated before the level of customer service is affected.

In these examples, real-time analytics provide decision support to a person — so a decision process that previously required hours or days can be accelerated to 15 minutes or less — bringing a variety of benefits to the company.

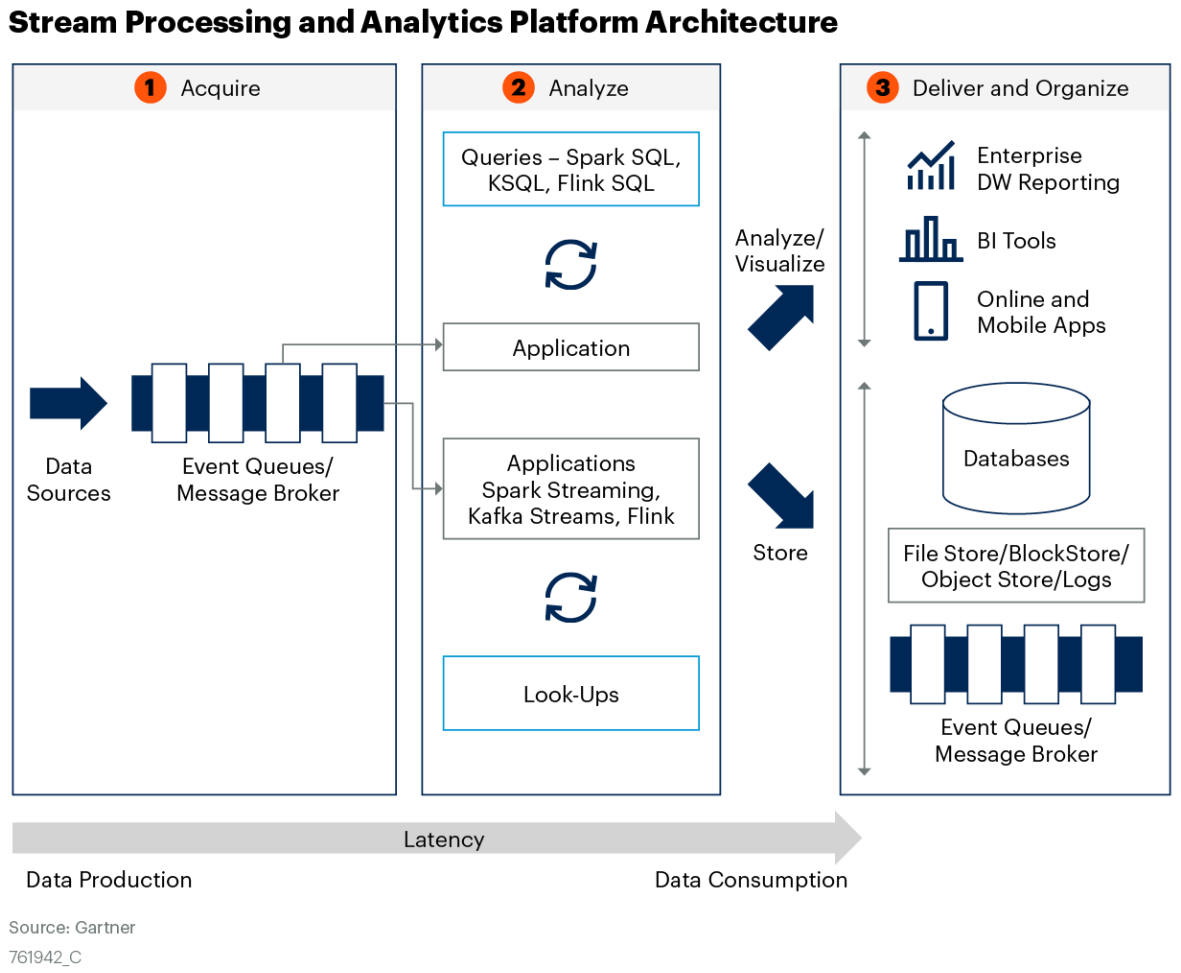
Figure 9: Determine Which Concept of "Real Time" Is Relevant to Your Business Problem



Enable

Even though real-time analytics usually elicits real-time action, analyzing and visualizing this temporal data can help intuitively drive understanding and insights. This can further lead to faster decision making and analysis, along with proactive preparedness for any anomalies. To achieve real time data pipelines, there is a requirement for a paradigm shift in the way data is ingested, processed, consumed and stored. Typically, batch-based data pipelines have been “store first, process later,” wherein first the source data was loaded into a centralized repository, and then processed. Finally, it was fed to the analytical model or system for generation of visualization or insights. On the contrary, in real time data pipelines, a “process first, store later” paradigm needs to be adopted. This involves moving the data to the analytical model or insight/visualization engine quickly enough to preserve the time value of data, without degrading the quality of the decision. Additionally, storing of data for archival or historical analysis is usually done after the data has been fed for analytics or via having parallel pipelines. This typical architectural pattern is illustrated in Figure 10. Further reading on how to enable streaming data systems, along with considerations for the same, are shared in Stream Processing: The New Data Processing Paradigm.

Figure 10: Stream Processing and Analytics Platform Architecture



Mainstream A&BI tools, such as Power BI, Qlik and Salesforce (Tableau) and TIBCO Spotfire, offer real-time analytics capabilities, but often require a robust, real-time pipeline to feed them coherent real-time data along with varying limitations. Niche tools that are specifically built to handle these visualizations in real time are emerging. Some notable open-source examples are Apache Superset, Grafana, Kibana and Streamlit. Further, typically the purpose of real time analytics is to achieve operational automation and efficiency, rather than visualizing data so a human can infer insights from it. This would hinder the time value of data and defeat the purpose of “real time” in many cases. Technical professionals should thus frame their use cases and architectures for real time analytics with these considerations in mind.

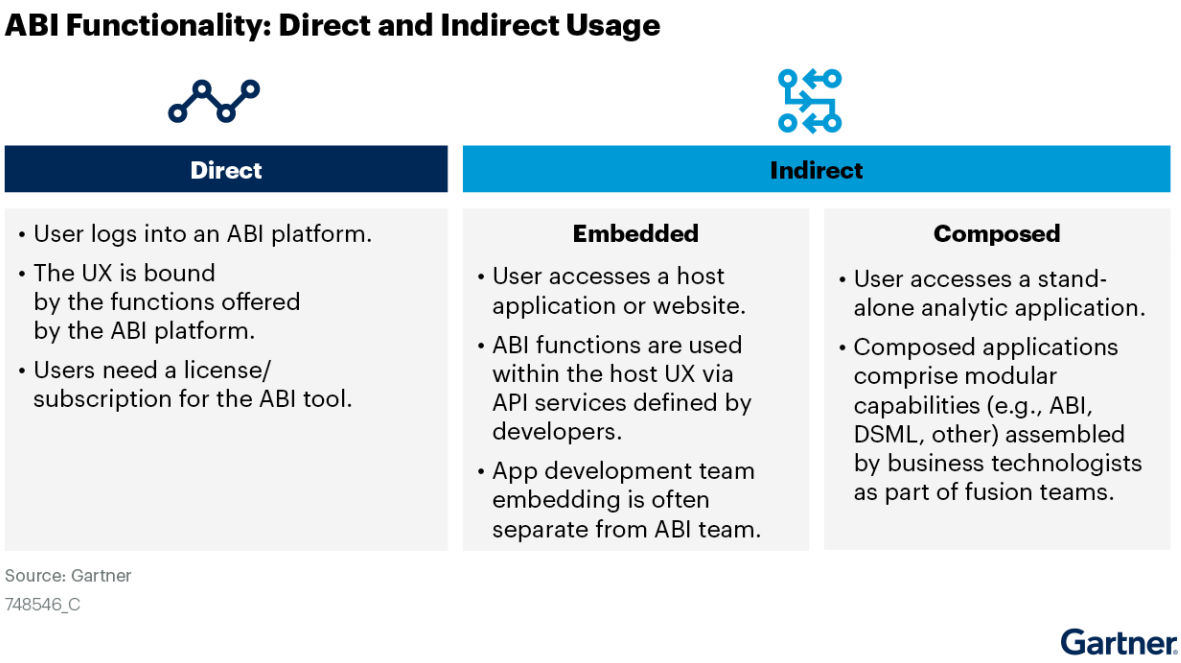
Embedded & Composable Analytics

Description

Gartner defines embedded analytics as a digital workplace capability where data analysis occurs within a user's natural workflow, without the need to toggle to another application. Moreover, embedded analytics tends to be narrowly deployed around specific processes, such as marketing campaign optimization, sales lead conversions, inventory demand planning and financial budgeting. It is software that delivers real-time reporting, interactive data visualization and/or advanced analytics — including machine learning — directly into an enterprise business application. The data is managed by the analytics platform, and the visualizations and reports are placed directly within the application UI to improve the context and usability of the data for business users.

The definition of the embedded analytics market is changing as the availability of low-/no-code interfaces, drawing on the services originally exposed via APIs to support embedding and become available in modular form, thus enabling non-developers to compose stand-alone analytic applications. These capabilities are enabling citizen developers who may lack coding skills to extend the reach and connectedness of how A&BI is consumed within the organization (e.g., to trigger workflow processes in operational apps based on analytic outputs). It even enables them to compose and self-publish analytic applications (see Figure 11 and Top Trends in Data and Analytics for 2021: Composable Data and Analytics). Composable analytics is a new trend, and evolving capability in the analytics experience that involves the use of low- and no-code capabilities to go beyond embedded analytics, authoring consumer-focused applications from existing analytics assets.

Figure 11: A&BI Functionality: Direct and Indirect Usage



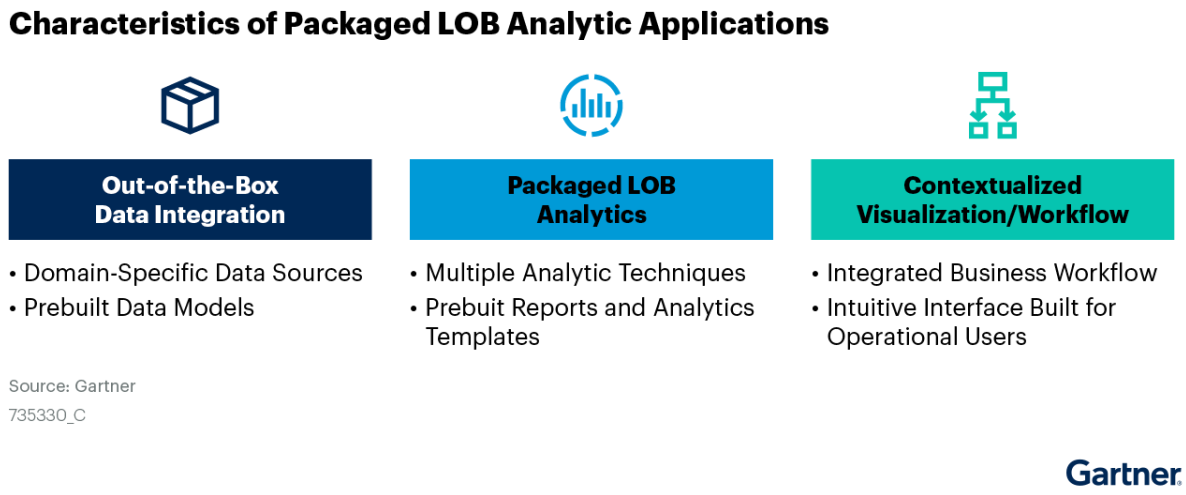
Impact

Historically, enterprise application providers have tried to build analytics in-house, which has impacted time to market, rather than considering sourcing options from embedded analytics providers. Part of the reason for this was that stand-alone analytics offered by software providers that sell primarily to end-user organizations were often not designed or optimized to be embedded into other enterprise applications.

However, in the modern A&BI user environment, both enterprise application providers and end-user organizations embedded more analytic dashboards and visualizations — both internally and externally — and want to take advantage of vendors and offerings that can enable this practice. The look and feel of the embedded analytics solution can directly impact the impression of the overall enterprise application and customer experience. Moreover, embedding is not just about visualization anymore. End-user organizations are choosing enterprise applications that offer embedded machine learning in addition to those that just provide basic reporting and dashboards.

Exploring packaged analytic applications before deciding to build custom solutions in-house can be beneficial, especially when domain specific data sources and models are needed by these applications. The typical characteristics of packaged and embedded analytics applications are shown in Figure 12 and can be read about further in When to Choose a Line-of-Business Analytic Application.

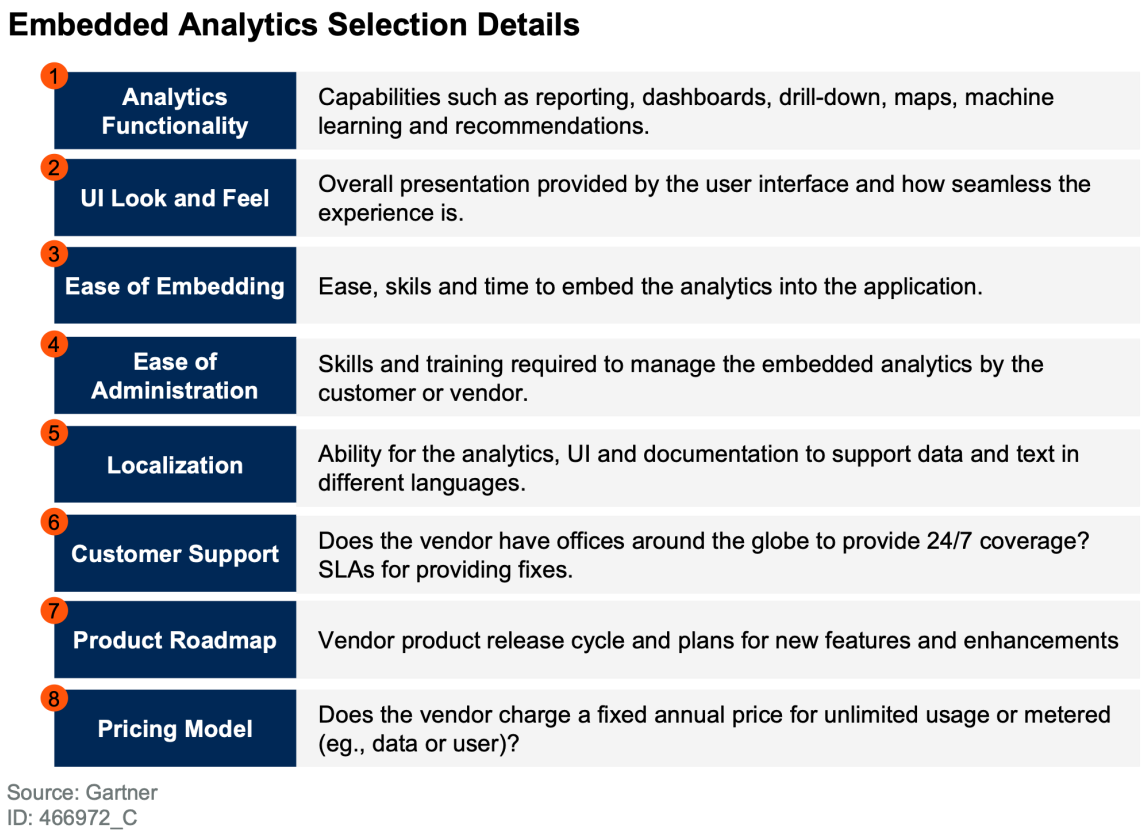
Figure 12: Characteristics of Packaged LOB Analytic Applications



Enable

Organizations have many options for embedded analytics in the vendor marketplace, but not every vendor will be a good fit for embedded use cases. As shown in Figure 13, these capabilities correspond to a different set of selection details, which include functionality and look and feel — but extend to ease of embedding, localization, customer support and pricing model. These are crucial to ensure that the embedded platform can deliver not just beautiful visuals, but the pricing, support and international-friendly experience that major software vendors and end-user organizations require.

Figure 13: Embedded Analytics Selection Details



Source: Gartner
ID: 466972_C

Gartner

A wide variety of embedded analytics options are available in the market. Tech providers providing embedding analytics capabilities fall into one of three categories and include some (but not all) of the following sample vendors:

- Specialists: Providers that focus exclusively on selling embedded analytics to independent software vendors (ISVs) and end-user organizations building applications.

Sample vendors include: insightsoftware (Exago BI Software), GoodData, Highsoft, Jinfonet Software, Plotly, Logi Analytics (Global Software), Izenda, and TIBCO Software (TIBCO Jaspersoft)

- Major: Providers in which a significant portion (more than 25%) of their business is from selling embedded analytics.

Sample vendors include: Infor Birst, Looker, Sisense and Yellowfin

- Minor: Providers in which a smaller portion (less than 25%) of their business is from selling embedded analytics and the product is primarily designed for end-user organizations. Products may or may not have been modified to support embedded analytics use cases.

Sample vendors include: MicroStrategy, Pentaho, TIBCO Software and Qlik

Increasingly, products like Amazon QuickSight, Microsoft Power BI, and Salesforce (Tableau) are also competing in the embedded analytics world, and fit into the Minor category.

For further details on the embedded analytics landscape and vendors, refer to Market Guide for Embedded Analytics. There are multiple levels in which analytics is embedded into applications, either as stand-alone analytics applications or being fully infused within core workflows of business applications (see Yellowfin's Embedded Analytics Maturity Model to get an understanding of these levels and plan your embedded analytics journey accordingly).

Other Upcoming and Niche Capabilities

Geospatial Analytics

Geospatial analytics involve overlaying multiple datasets on a map to understand the geographical relationships between them. Multiple vendors offer a maturing set of location intelligence platforms, which provide a comprehensive set of location data management, spatial analytics and location execution software. Geospatial analytics add another dimension to the insights and reveal patterns that are otherwise not obvious. Today, geospatial analysis is used for data capture to understand anything from weather modeling, population forecasting and sales trends. Further, geospatial big data analytics breaks data out of the endless rows and columns of a traditional spreadsheet and organizes it visually by time and space. It is easier for the human brain to absorb information this way. Geospatial data analytics lets the eye recognize patterns like distance, proximity, contiguity and affiliation that are hidden in massive datasets. The visualization of spatial data also makes it easier to see how things are changing over time and where the change is most pronounced.

Benefits of geospatial analytics include:

- **Engaging insights:** Seeing data in the context of a visual map makes it easier to understand how events are unfolding and how to react to those events.
- **Better foresight:** Seeing how spatial conditions are changing in real time can help an organization better prepare for change and determine future action.
- **Targeted solutions:** Seeing location-based data helps organizations understand why some locations and countries, such as the United States, are more successful for business than others.

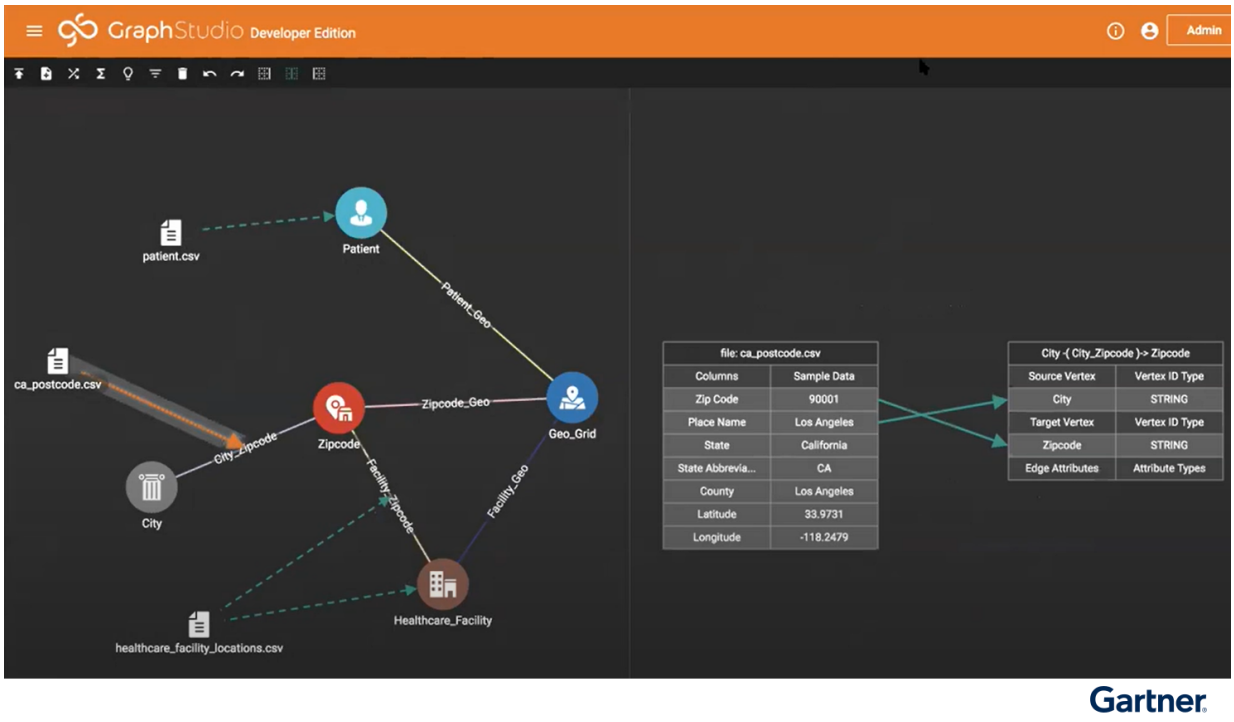
Geospatial imagery analytics provides video and image data of the earth. Companies in many sectors use this data to determine future risk and contingency plans, using data collected from satellite images. The geo-referenced images are then presented as raster and vector images, on which analytics can be visualized.

The Geospatial market is subdivided into multiple niches like GIS (geographic information system) and location intelligence or spatial intelligence. Location intelligence, which is a part of BI, is the process of deriving meaningful insight from geospatial data relationships to solve a particular problem. There are multiple vendors spanning across these niches with varied capabilities and maturity, shared below:

Pure-play vendors: CARTO, Esri, HEAVY.AI, Precisely, QGIS, Kinetica and Supergeo — geospatial intelligence or location intelligence — augment visualizations spatially. **Python libraries:** GeoPandas, geoplot, GeoViews, Plotly and Kepler.gl — code-based geospatial visual analytics.

Typically to enable geospatial analytics, organizations need to move beyond just geospatial visualization — which is plotting data points on a map — and toward geospatial analytics which, depending on your use case, may need to acquire additional data layers like building or business names, postal code boundaries or other types of geofences, road features, driving speeds, weather data, etc. This needs to be backed by GIS and Map APIs for efficient mapping of these insights. Further, complementary techniques like graph analytics can really substantiate and augment geospatial insights, as illustrated in Figure 14 below.

Figure 14: Example Geospatial Graph Analytics Tool - TigerGraph



Source: TigerGraph

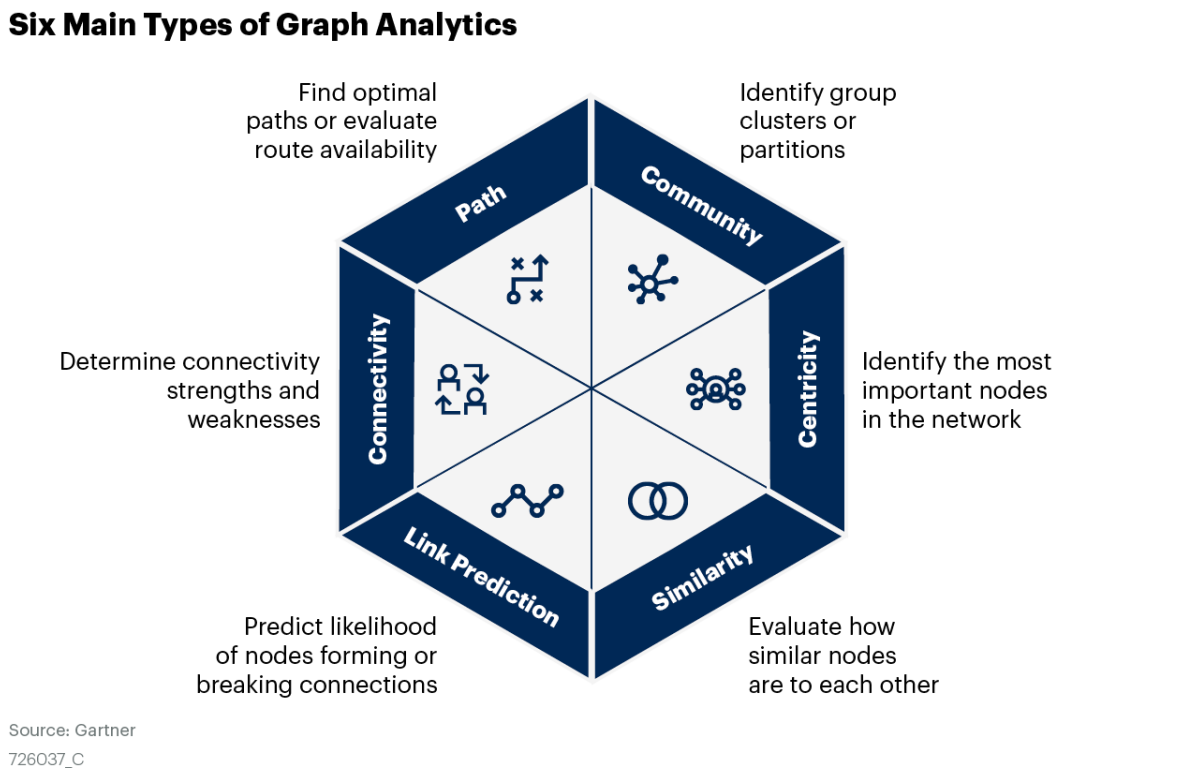
Graph Analytics

Another technology enabling innovative visualization and novel insights is graph analytics. Graph analytics, also called “link analysis” or “network visualization,” is the process of visually presenting connected entities as networks of nodes and links. It is used to represent entities, such as concepts, people, objects and places, and how they relate to or interact with each other.

Graphs can be analyzed in many ways. For example, they can identify nodes with similar interaction patterns to calculate the shortest path between remote nodes and determine which nodes are most central/peripheral — or to identify clusters or partitions within a larger network. The visualizations are interactive, giving an intuitive way to explore complex connected data at scale.

Graph analytics should be leveraged when the primary business questions are about the relationships between data, rather than data values themselves. Graph analytics can extend the potential value of the data discovery capabilities in modern A&BI platforms. It particularly excels in data discovery and metadata discovery. While traditional analytics focus on answering a predefined set of questions or business outcomes, graph analytics enable users to discover previously unknown or unanswered questions and relationships. The six main use cases of graph analytics, shown in Figure 15, depicts when to leverage graph analytics and visualize them for a better understanding of data correlation. For further details, see Understanding When Graph Technologies Are Best for Your Business Use Case.

Figure 15: Six Main Types of Graph Analytics



Novel techniques are developing that make it easier to perform graph analytics across structured and unstructured sources, without the need to move the data. Improved, scalable and lower-cost processing options, such as cloud and GPUs, are making graph analytics and databases prime candidates for accelerated adoption. Vendors are also offering packaged graph analytics applications for specific use cases, such as investigative intelligence, fraud analytics and cybersecurity.

Gartner predicts that the use of graph processing will grow 100% annually through 2022 to enable more complex and adaptive data analytics. Niche vendors, such as Kineviz (GraphXR), Graphistry, Linkurious, TigerGraph and Neo4j, and open-source libraries and technologies like D3.js, Gephi, Plotly and RAW Graphs, are enhancing the capabilities of graph visualizations. Mainstream A&BI vendors are also allowing some level of graph analytics, but typically a Graph DB is imperative to achieve full scale graph analytics from relationship data. Market Guide for Graph Database Management Solutions and the Graph Technology Applications and Use Cases research can help in decisioning around Graph Analytics enablement and decision making.

Modern BI and the Broader Analytics and AI Architecture

Architect for a Portfolio of Intelligence and Analytics Systems

With the onset of multiple data repositories and analytical solutions, it is imperative for A&BI technical professionals to architect for an assortment of intelligence and analytics solutions — regardless of where data is stored or where it resides. Data management should remain central to your architecture. However, you must also devote time to the following:

- Specifying how to interconnect different types of analytics solutions (e.g., AI, BI or ML)
- Managing the communications among the solutions

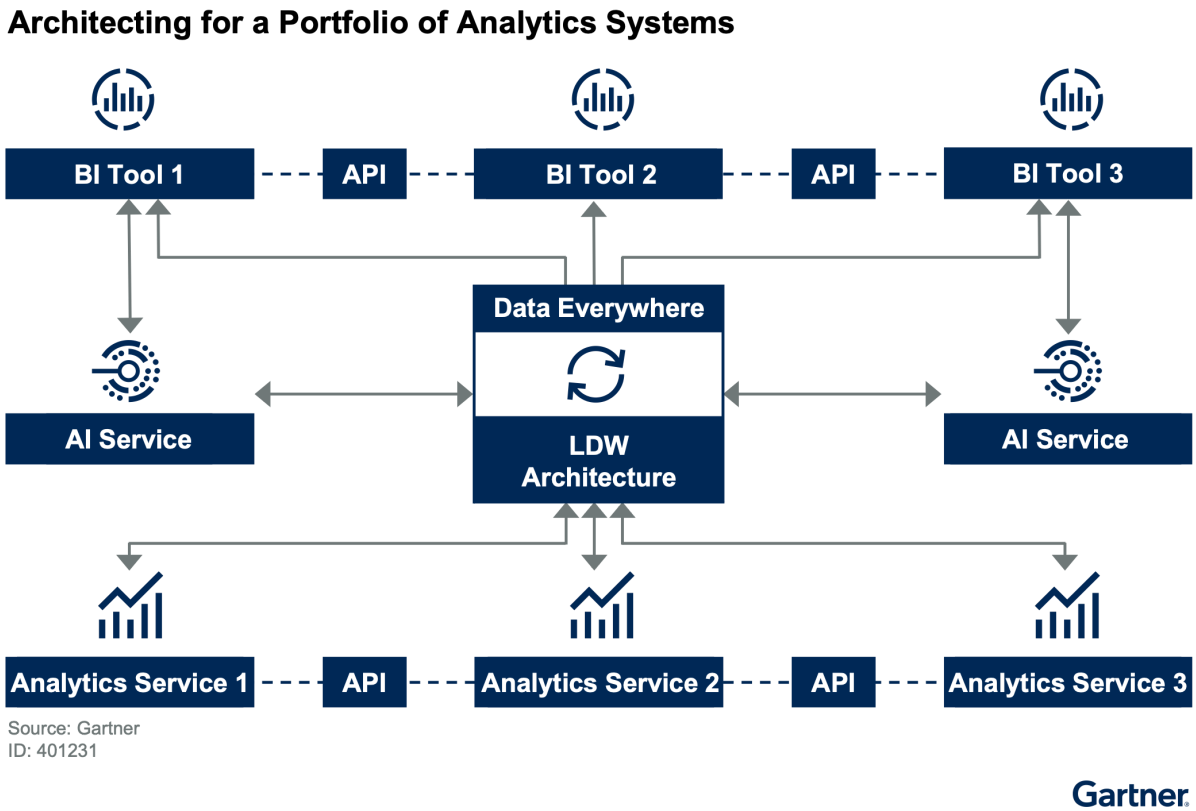
For example, it is common practice to leverage a federated reference model to support different types of A&BI solutions. However, the federated reference model should be capable of supporting a network of analytics solutions that are linked together to solve a broader objective. This network includes not only A&BI solutions sharing information with other A&BI solutions, but also AI methods informing A&BI solutions using bidirectional information flows. The link between BI solutions and AI methods is also known as “AI-assisted BI” or “AI-powered BI.”

In a portfolio of intelligence and analytics solutions, the architecture is the technical framework that designates:

- The way users will employ the solutions
- The internal and external relationships and dependencies among the constituent solutions
- The end-to-end functionality, data flows and communication among the different solutions

Extend federated implementation models and federated reference architectures for existing analytics systems to include ML capabilities and AI-powered BI. For example, Figure 16 shows a federated BI implementation model updated to include AI and ML services. A federated A&BI implementation model is a good place to start adding AI-powered, augmented analytics, as well as diverse analytical services that may extend to remote infrastructures or various cloud configurations. To read further around the same, refer the Reference Architecture to Enable Self-Service Analytics.

Figure 16: Architecting for a Portfolio of Analytics Systems



Collaborative Platforms for Building and Trading Analytics Outputs

Managing and maintaining multiple analytics platforms is a time-consuming process that requires significant overhead, and it doesn't always scale well for technical professionals as new user requirements and technology capabilities emerge. To reduce overhead and gain economies of scale, technical professionals must place more emphasis on unifying analytics platforms, and on promoting reuse and sharing of analytics outputs.

Pay specific attention to users who request to share their analytics outputs or findings with other users who leverage different analytics platforms. This is a growing trend, as the domain expertise is embedded into the analytics output. Traditionally, users would integrate data first and then apply business logic on that integrated data. In this new paradigm, however, the analysis is performed before any significant integration occurs. The shift from data integration to analytics integration reduces data management overhead. This approach is not ideal in all use cases, and it does not eliminate the need for a solid data integration strategy. However, there is value in embedding domain knowledge into the analysis — and in sharing the output of that analysis with other forms of analysis from various business domains.

This has given rise to the concept of "Headless BI," or Metrics Stores or Layers. Some of the key features of typical headless BI platforms are —

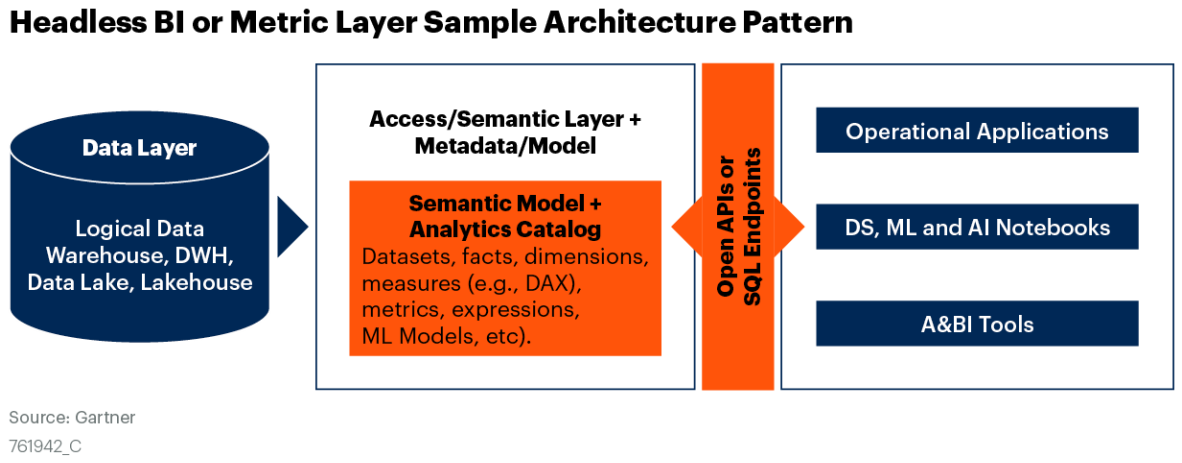
- A single source of metrics
- Analytics that are tracked in real-time
- Open APIs
- Architecture that allows for microservices
- Declarative definitions
- Composable and efficient UI
- Ultra-flexible deployment

Some of the representative vendors propagating this trend are Supergrain, Transform Data, Metriql, dbt Labs, GoodData (Multi-Dimension Analytical Query Language), Looker (LookML), Trace, AtScale and Cube Dev. All of them take varied approaches with their focus, ranging from metrics consolidation to semantic layer enrichment to API enabled A&BI architectures. Most importantly, they help balance the agility of self-service platforms with the control and governance of centralized analytics.

Many a time, these headless solutions are augmented with analytics catalogs, which have emerged amid increased adoption of multiple A& BI technologies among organizations. An analytics catalog combines portal-like capabilities with curation and collaboration functions, and applies them to analytics content — similar to how data catalogs organize data from many sources. This enables users to share, find, search, comment, and rate dashboards, reports and datasets from a diverse range of platforms. Some of these tools also enable users to develop a unified and consumer-focused user experience across a diverse range of analytics content.

This type of composition will increase usage of the organization's existing analytics portfolio. Adoption would be further boosted with the introduction of machine learning, with the active usage of metadata to provide a "Netflix of BI" experience. Some of the representative vendors in the analytics catalog space are Digital Hive, Enquero, Metric Insights, Visual BI and ZenOptics. The typical implementation architecture pattern for Headless BI or Metric Layers is shared in Figure 17 below, with the Access/Semantic layer of the Logical Data Warehouse or data layer being enriched with centralized metric logic and an analytics catalog.

Figure 17: Headless BI or Metric Layer Sample Architecture Pattern



Good practices for implementing collaborative platforms to build and trade analytics outputs include:

- Manage the integration of analytics output — not just the integration of data — by promoting the distinction between the following:
  - Data integration in support of generalized analytics services.
  - Analytics integration with embedded domain knowledge in support of broader, more complex decision making. For example, a financial analyst may share their analysis of financial worthiness, with an operational analyst evaluating the usage of goods or services provided.
- Build connections between diverse forms of analytics output. For example, provide the capability to seamlessly connect ML predictions to existing BI dashboards.
- Generate an analytics distribution platform that allows users to browse and obtain various forms of analytics outputs to support their decision-making processes.
- Lead to augmentation of Analytics to a level, where it embeds perfectly within the business decision framework.

Related to this analytics distribution platform, implementing a process to track analytics requests and attempt to align them to requirements can be a good way to fit requests to platforms. This can also help to evaluate the long-term cost of different analytics platforms.

Strengths

Table 2: Strengths of Evolving Capabilities of A&BI Platforms

(Enlarged table in Appendix)

Capability	*Strengths*
Augmented Analytics	■ Automated workflow, ease of use, automated insights ■ Spend more time on insights and exploration rather than on data manipulation
Conversational/Natural Language Analytics	■ Democratization of analytics process with natural language ■ Easy to understand user interfaces with intuitive insight generation ■ Visualizations going away, users just need actionable insights
Streaming Analytics	■ Real-time insights, operational efficiency and real-time decision automation use cases ■ Proactive predictive, prescriptive and diagnostic analytics, continuous intelligence ■ Automation of detection, response and resolution-based systems
Embedded Analytics	■ Line of business analytics as part of business decision workflow ■ Decreased time to analytic value ■ Contextualized solutions for particular domains
Geospatial & Graph Analytics	■ Add another dimension to the insights and reveal patterns that are otherwise not obvious ■ Complement traditional analytics in both data discovery and insight generation
Consolidated & Collaborative Analytics Architectures (Metrics/Semantic Layers and Headless BI)	■ Single source of truth, single understanding of truth, single way of calculating the truth, while allowing diversity ■ Balancing agility of self-service with governance of centralization

Source Gartner: (April 2022)

Weaknesses

Table 3: Cautions & Pitfalls of Evolving Capabilities of A&BI Platforms

(Enlarged table in Appendix)

Capability	*Weakness/Cautions*
Augmented Analytics	■ Explainability and transparency of underlying models and data needs to be considered ■ Level of flexibility and granularity to which data can be manipulated is decreased
Conversational/Natural Language Analytics	■ Explainable/Transparency concerns similar to augmented analytics ■ Trust in natural language-based insights needs to be instilled without looking at underlying data ■ Data needs to be modeled specifically to serve the NLP technique
Streaming Analytics	■ Hard to deploy and maintain at scale ■ Might need rearchitecting the data pipelines from source
Embedded Analytics	■ Still not mature enough to provide robust analytics within the application workflow ■ Could cause siloed analytics and decisioning
Geospatial & Graph Analytics	■ Allied resources needed for data storage, standardization, quality and security.
Consolidated & Collaborative Analytics Architectures (Metrics/Semantic Layers and Headless BI)	■ Hindrance to pure self-service, not as agile ■ Ambiguity on implementation patterns and differentiation between headless BI/metrics stores and traditional semantic layers

Source: Gartner (April 2022)

Guidance

- Assess the impact of the evolving capabilities enlisted in this research vis a vis the enablement overhead to achieve them, either via a stand-alone platform, or as extensions in your current implementation. Based on that, strategize a build versus buy versus adopt decision.
- Understand in which phase of the Augmented Analytics workflow the value proposition lies for your implementation, and choose A&BI platforms/capabilities accordingly.
- Implement guardrails into human and automated insights and ensure that there is transparency and explainability of the underlying models.
- Follow the guidance of Reference Architecture to Enable Self-Service Analytics and Solution Path for Modernizing Analytic Architectures. This guidance will help you to enable platform diversity via a federated BI platform approach, while building data and analytics capabilities from the ground up.
- Use a multidimensional decision-making approach to decide which platform to align to which analytical workload: At a high level, evaluate the cost and effort required to deliver analytical capabilities over a set time period against the benefit of gaining these analytical capabilities.
- Lockdown self-service adoption until you are sure that you can deliver capabilities in a secure and controlled manner: In many organizations, this means that self-service is restricted to datasets that have row- or column-level security enabled. In other scenarios, direct query is used to have the BI tool directly access a dataset on the production database — although this approach can cause performance problems as it scales. In more risk-averse organizations, only a small subset of BI administrators has self-service capabilities, and the rest of the users have read-only access.
- Design and build a modular analytics platform — only use modern BI as an end-to-end data platform in scenarios where you are comfortable getting locked in to a specific product: Connect, don't collect. This provides you with the flexibility to scale a specific capability, or introduce a new one with minimal integration effort and impact on the overall architecture. Modern analytics and BI vendors want you to take data out of where it currently sits and place it into their platform. They trumpet the value of doing this by emphasizing advanced visualizations and the potential of empowering the user. However, in doing so, they are encouraging the development of data silos. You don't want your business and IT operations teams to be limited by a stand-alone solution that is neither modular nor extensible.

- Provide appropriate communication and adequate training: Delivering self-service capabilities is not just about enabling users to do more for themselves, but also about a transfer of responsibility from IT to the users to follow the appropriate governance and compliance rules. Build strategic partnerships within the business — and clearly communicate the roadmap and changes to the existing process, as well as the new responsibilities that self-service users are taking on. Educating and training users on new processes and tools will ensure successful onboarding and adoption of the new platform. This can be done by partnering with vendors and conducting workshops to train the users.
- Strictly enforce policies and processes to adhere to the recommended workflow: This can be achieved by a central BI or data governing council. Conduct periodic reviews of analytics project implementations to prevent any deviations from the recommended approach. For best practices, refer to Data and Analytics Governance Approaches for the Technical Professional.
- Battle test augmented solutions before deploying to production as end users' adaptability and acceptance to AI-based A&BI technologies depends on their accuracy and efficiency.
- Tread with caution before adopting too many A&BI tools, as they may be a short-term business solution but usually turn out to be a long-term IT nightmare, adding to technical debt.
- Understand the importance of collaboration and consolidation in your A&BI implementation and leverage concepts of Headless BI, Metrics Layers and Analytics Catalogs to trade and share analytics outputs.

Evidence

[1] Gartner Glossary Definition of Augmented Analytics

Document Revision History

Evolving the Capabilities of Analytics and Business Intelligence Platforms - 18 March 2020

The Evolving Capabilities of Analytics and Business Intelligence Platforms - 20 April 2018

Recommended by the Author

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

Communicate Insights Effectively With Augmented Data Visualization and Storytelling

Reference Architecture to Enable Self-Service Analytics

Important and Compelling Innovations in the Analytics and BI Platform Market

Data and Analytics Worlds Collide: A Gartner Trend Insight Report

Product Roadmap Priorities: Analytics and Business Intelligence Platforms

Analytics and Business Intelligence Vendors Are Acquiring Augmented Analytics Vendors

Demystifying Semantic Layers for Self-Service Analytics

Demystifying the Analytics and BI Space

Solution Path for Modernizing Analytic Architectures

Table 1: Traditional Enterprise Reporting to Modern A&BI

Traditional Enterprise Reporting Platform	Modern Analytics and BI Platform with Augmented Analytics
IBM Cognos Business Intelligence 10.x	IBM Cognos Analytics 11.x
Microsoft Analysis Services/SQL Server Reporting Services	Microsoft Power BI
Oracle Business Intelligence Enterprise Edition (OBIEE)	Oracle Analytics Server (OAS) and Oracle Analytics Cloud (OAC)
QlikView	Qlik Sense
SAP BusinessObjects - Web Intelligence (WebI), SAP Crystal Reports, SAP BusinessObjects Design Studio (SAP BusinessObjects Lumira 2.0)	SAP Analytics Cloud
TIBCO Jaspersoft	TIBCO Spotfire

Source: Gartner (April 2022)

Table 2: Strengths of Evolving Capabilities of A&BI Platforms

Capability ↓	*Strengths* ↓
Augmented Analytics	■ Automated workflow, ease of use, automated insights ■ Spend more time on insights and exploration rather than on data manipulation
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Capability ↓	*Strengths* ↓
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Source Gartner: (April 2022)

Table 3: Cautions & Pitfalls of Evolving Capabilities of A&BI Platforms

Capability ↓	*Weakness/Cautions* ↓
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